ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

L. W. W. MORROW, *Editor*

ALLEN M. PERRY
Managing Editor

A. E. KNOWLTON
Associate Editor

E. R. SEARLES
News Editor

G. F. WITTIG
Statistical Editor

EARL WHITEHORNE
Contributing Editor

JAMES H. RUDD
Publishing Director

FRANK R. INNES
Western Editor
520 N. Michigan Ave.
Chicago

C. W. LEIHY
Pacific Coast Editor
883 Mission St.
San Francisco

H. S. KNOWLTON
Contributing Editor
1427 Statler Bldg.
Boston

PAUL WOOTON
Washington
Correspondent
National Press Building
Washington

What in the World!

Technical experts claim they can make a transmission line immune from lightning. The best proof of these claims lies in actual performance, and F. S. Douglass submits some very interesting and valuable evidence in this issue to support the claims of the specialists.

●

Capital values and capital accounting will be a dominating financial problem of the industry in the future. Some very truthful and thought-inspiring comments are made on the subject in the McGraw Prize Award paper by W. J. Lyman in this issue. Some may disagree with his suggestions, but we believe he is logical and sound and that this problem must be faced courageously and quickly by the utility industry.

●

Much loose and speculative talk has been had about the sodium vapor light. It has reached a stage of development that is promising and is in practical use for street lighting. In this issue Mr. Luckiesh contributes some valuable data on the contrast characteristics of the new light.

●

The major objective of all branches of the electrical industry is sales. Electrical products and service must be sold by new methods on an unprecedented scale. The article by Mr. Whitwell is one of many that we have in process to show the best thought and practice available to carry out the objective. There is no short cut and only hard work under well-organized leadership will bring results.

●

Reports about the Century of Progress are very favorable. It is a success. And the electrical industry can take a large part of the credit for electric lighting and electrical exhibits are the outstanding attractions. All electrical men will be repaid by a visit to Chicago.

Swiss railway electrification

JUNE 24, 1933

Contents, Copyrighted, 1933, by McGraw-Hill Publishing Company, Inc.
VOLUME 101 . . . NUMBER 25

Rehabilitated Line Defies Lightning 820
By F. S. DOUGLASS, *The Management & Engineering Corporation*

Trend in Fixed Capital Replacements 825
By W. J. LYMAN, *Duquesne Light Company*

Commercialism and Competition 829
By GEORGE E. WHITWELL, *Philadelphia Electric Company*

Protecting Motors in Severe Service 832
By R. S. ELBERTY, *Westinghouse Electric & Manufacturing Company*

Primary Network Economical for Medium-Load Densities 835
By JOHN S. PARSONS and LEONARD M. OLMSTED, *Westinghouse Electric & Manufacturing Company*

Molasses Heating for Feed Mills .. 822
Industry 10% Over 1932 323
South and West Also Gain 824
Electrical Industry Breaks Through 824
Contrasts in Sodium Vapor Light .. 827
Minimum Charge Clause Should Be specific 328
Shadowless Lighting in Surgery ... 831
Large Hydro Unit Adapted for Sensitive Governing 834
Effect of Power-Factor Correction on Demand Charges 838
Safety Guy Hook 838
Book Reviews 839
Men of the Industry 840

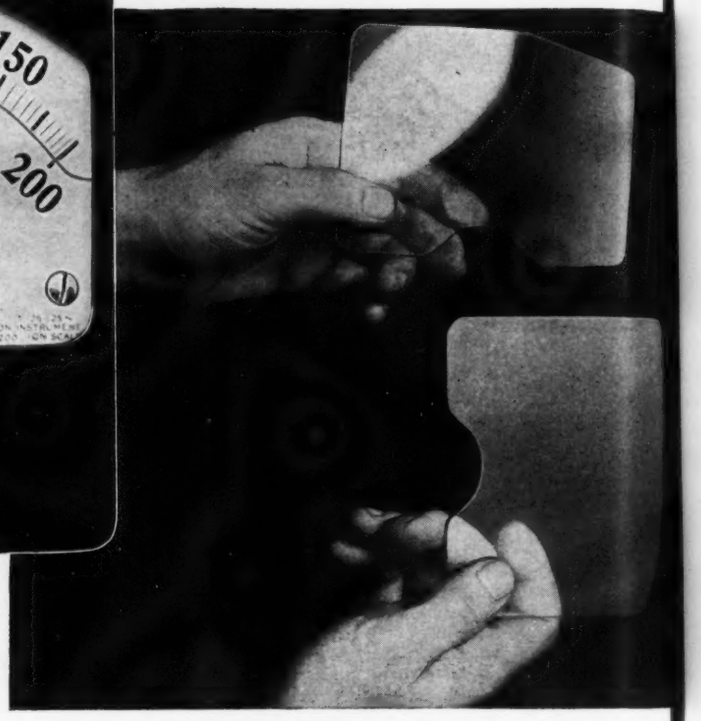
Electrical World articles are indexed in Industrial Arts and Engineering Indexes, available in public libraries

Published weekly. $5 per year. 25 cents per copy. Central and South American countries, $7. Foreign, $9 U. S. currency, or 45 shillings per year. Canada subscription price (including Canadian duty), $7.50. Entered as second-class matter, January 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U.S.A. Cable Address: MCGRAWHILL, N. Y. Member A.B.P. Member A.B.C. Number of copies printed in this issue, 12,920.

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C. James H. McGraw, Chairman of the Board; Malcolm Muir, President; James H. McGraw, Jr., Vice-President and Treasurer; Mason Britton, Vice-President; Edgar Kobak, Vice-President; H. C. Parmelee, Vice-President; Harold W. McGraw, Vice-President; B. R. Putnam, Secretary.

ANNOUNCING A NEW AND



At the top, ordinary glass; below, antiglare glass. In instructing our photographer to take this picture, we told him to adjust his lights so as to get a maximum of glare on both panes. Note that you actually cannot see through the ordinary glass where the light strikes it

THESE new G-E rectangular switchboard instruments have the following ten points of advantage:

1. Antiparallax Scale and Pointer

You can read one of these instruments accurately at practically any angle from the front. The scale plate is so formed that the tip of the pointer is in the same plane as the scale markings—a construction that eliminates parallax errors.

2. Antiglare Glass

From whatever angle you view the instrument you can always see through the glass. No reflections, no glare. This antiglare feature is distinctively General Electric.

3. Easy to Read

In addition to Points 1 and 2 (above), there are other features which make for quick and accurate readings.

Note the scale markings, the rounded shape of the pointer, and the size of the tip. These are new.

4. High Factor of Merit

The mechanical factor of merit of these new G-E instruments is unusually high. For example, for a 5-ampere, 115-volt, polyphase wattmeter it is 2.02.

5. Magnetic Damping

This is another distinctive G-E feature. Magnetic damping not only keeps the "overshoot" low, but also makes for permanency of performance.

6. High Torque

The higher the torque of an instrument, the less likely it is to stick; i.e., its operation is more reliable, more positive.

All these new G-E instruments have high torque. For example, the value for a 5-ampere, 115-volt, polyphase wattmeter is 18.7 millimeter-grams.

7. Responsiveness

This term denotes the rapidity with which the pointer comes to rest. The responsiveness for a 5-ampere, 115-volt, polyphase wattmeter is 1.6 seconds.

8. Characteristics Permanently Constant

In the a-c. voltmeter of the Thomson inclined-coil type, for example, the stationary field coil, the movable vane, the stationary scale, the movable pointer, the stationary magnets, the movable aluminum vane, and the control springs—all these parts are so designed, constructed, and correlated that the characteristics of the instrument will remain constant over long periods of time.

9. Three Styles of Cases

Cases are available for either surface or semiflush mounting; also, three-element cases.

ELECTRICAL WORLD

Established 1883. McGraw-Hill Publishing Company, Inc.

for the Week Ending

June 24, 1933

Pennsylvania Probe to Continue

UNPERTURBED, but quite indignant, the Pennsylvania Senate committee appointed to investigate the state Public Service Commission has declined to accept dismissal by Governor Pinchot (ELECTRICAL WORLD, June 10, page 740). In a formal statement issued several days after the Governor's charges of insincerity were made, and the appropriation for continuation of the investigation vetoed, the committee said, in part:

"It is with amazement that the committee has read the statement of Governor Pinchot in explanation of his veto. On March 20, 1933, the entire committee conferred with the Governor at the Executive Mansion, pledging itself to a full, complete and impartial investigation, and asking the Governor's co-operation. He cheerfully pledged the same, and publicly stated that he would approve the resolution continuing the investigation committee. As a result of this promise, the committee proceeded vigorously with its work, engaging counsel and accountants, and arranging for testimony. Later, in April, at a second conference the Governor made accessible to counsel for the committee whatever records, data and information that had been assembled by the Executive Department concerning the investigation. Relying on the Governor's promise, the committee announced that public hearings would be resumed in June, and necessary arrangements were made with witnesses whose testimony relates to the inquiry.

Investigation will go on

"It is not necessary for us to comment upon the Governor's reckless use of abusive terms, and it will be sufficient for us to direct attention to the fact that the Governor submitted vague and indefinite charges against one of his appointees, the chairman of the commission, Clyde L. King, and asked his removal.

"These charges merit and will receive the careful and impartial attention of the Senate, and if by his veto Governor Pinchot expects to prevent a full hearing on these charges, it is our judgment that he will find himself mistaken."

▼

Hartford Waives Rentals to Spur Range Use

As was more or less to be expected, the sale and rental of ranges at first slowed down after the free-wiring range-rental campaign of the Hartford Electric Light Company (see ELECTRICAL WORLD, March 11, 1933, pages 324-6) was over. To speed up the movement of ranges the company has recently offered to waive the rental fee during the period June 1, 1933-June 1, 1934, and to return two years hence the $15 installation charge provided the range is still in service at that time. Those who participated in the 50th anniversary free-wiring rental offer can have their rental fees of 30 cents per month waived for a year by paying the installation charge of $15 at $1 per month and then have the installation remitted two years hence if the range is still working. New customers renting after June 1 will also have the rental charges waived until June 1, 1934, and the $15 installation fee remitted after two years.

A prime objective of the rental scheme being to promote sales, there was also a new inducement offered in connection with ranges sold by dealers. The dealer's customer will receive a discount of the same amount, $15.60, as is represented by the waived charges for range renters. The dealers invoice this discount to the company; it decreases $1.30 per month to zero in June, 1934. On the other hand, these purchasers will pay $15 toward the wiring cost for a house unwired for a range and this will be credited back to them after two years of range use.

The measures of waived rentals and remitted installation charges after two years use were instituted when it was seen that additional inducement was needed to gain immediate saturation. The result was 250 additional rental orders in four weeks and orders are still continuing at the rate of about seven a day.

The net results since the beginning of the rental plan, February 1, are as follows: 396 installations on free-wiring plan, 47 installations with paid $15 installation in following three months, 141 installations on free-rental offer, 101 sales, 70 employee rentals, 136 awaiting installation; total, 891.

The cumulative gain last year to the same date, June 17, was only 134. It is evident that the various measures have worked well, and, too, there is no disposition to depart from the conviction that renting spurs sales.

▼

Roosevelt Signed Tax Bill

Late last week President Roosevelt affixed his signature to the post office bill which transfers the federal energy tax of 3 per cent from consumer to producer effective September 1 (ELECTRICAL WORLD, June 17, page 777).

▼

Another Eaton Auction

Auction of another block of securities owned by Continental Shares, Inc., but pledged to secure bank loans is scheduled. Collateral to be sold is that which has been held by various Cleveland banks. The loans which it involves total approximately $12,000,000. Sale is scheduled for June 27. Previous auction by the Chase National Bank (ELECTRICAL WORLD, June 17, page 780) netted some $23,240,000. With the latest sale completed, Continental Shares, once with assets of $156,000,000, will have shrunk to apparent dissolution levels.

Middle West Receivers Report on First Year

Net loss for the year 1932 by Middle West Utilities Company, Insull unit in receivership, was $2,799,582, according to the report just issued by the receivers.

In spite of continuously declining gross earnings of operating companies during the first year of their administration, the receivers point out that through the centralization in Chicago of executive and financial control of all companies and the inauguration of a stringent program of operating economies annual savings and reductions in expense of the operating subsidiaries alone already exceeded $10,000,000 as compared with the year ended December 31, 1931, while in addition the executive and administrative expense of Middle West (the holding company) alone, which for 1931 amounted to $2,092,000, had been progressively reduced to an estimated total for 1933 of only $500,000.

The financial condition of the Middle West System has materially strengthened since the date of receivership, with a total improvement in liquidity of more than $10,000,000, represented by a reduction in bank and other indebtedness of more than $6,000,000 and an improvement in cash position of approximately $4,000,000.

No evaluation of assets

No attempt has as yet been made by the receivers to evaluate the permanent assets of Middle West Utilities Company, consisting chiefly of controlling equity stocks in operating utility subsidiaries. This would require extensive appraisals of the physical properties of the operating companies. Such appraisals, the receivers believe, should be deferred until earning power has stabilized and until earnings reflect economies.

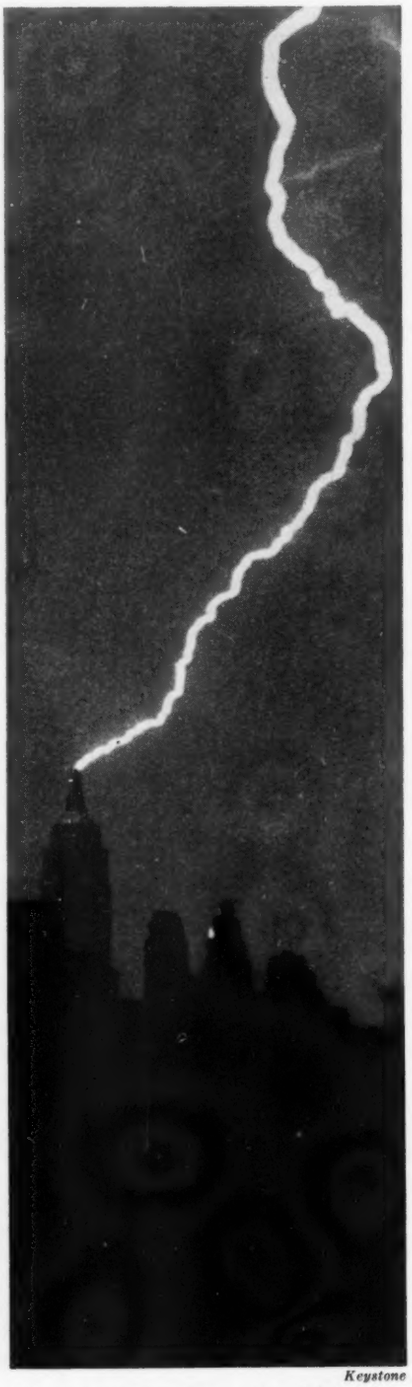
Consolidated income account of Middle West Utilities Company and subsidiaries for the year 1932 shows consolidated operating revenues of $66,751,860, of which more than 75 per cent was derived from sale of electricity. Non-operating revenue amounted to $1,651,428 additional.

After deducting operating expenses, including maintenance, provision for depreciation as determined by the operating companies and taxes, also interest and amortization on the funded debt of subsidiaries and dividends on the preferred stocks of subsidiary companies (exclusive of $2,391,799, accrued and unpaid dividends on cumulative preferred stocks of subsidiary companies on which dividends have been discontinued), etc., the balance of income available to the Middle West Utilities Company amounted to $3,241,460.64.

After interest on the serial gold notes paid prior to the receivership only, and general interest paid only to secured creditors, etc., and after also deducting a loss of nearly $4,000,000 on the liquidation of brokerage accounts, syndicate participations and miscellaneous trading operations, all prior to receivership, there was a consolidated deficit for the year 1932 of $2,799,582.

"As soon as may be practicable," say the receivers, "attention will be directed to the formulation of a reorganization plan which will recognize equitably the claims of the creditors and securities holders of Middle West Utilities Company."

Lightning Strikes New York's Empire State Building



Keystone

No laboratory test, this. Lightning played about the top of the world's tallest building for some minutes during one of the severe storms of a week ago. This picture is one of several secured during an interval when many strokes apparently headed for the Empire State Building.

Federal Trade Hearing Includes St. Louis Utility

Laclede Gas & Electric Company, whose troubled affairs have been the subject of two recent Missouri Supreme Court decisions (ELECTRICAL WORLD, April 29, page 533, and page 814 of this issue), was the center of attention at the Federal Trade Commission hearing in Washington last week.

Examiners related how in the course of three years the property was made to yield a transferable profit of $14,000,000. The procedure involved the transfer of 53,600 shares of Laclede Gas Light Company stock and later financing. Charles A. Munroe, testifying on behalf of the company, agreed that the profit was made without additional investment by the original participants in organizing the Laclede Gas & Electric Company, but offered this explanation to the commission:

"The Laclede Gas & Electric Company when sold in 1927 was a very different property than when formed in 1924. We were able to do things making its earning capacity entirely different and our ability to do this enabled us to sell at a $14,000,000 profit."

He explained a $9,000,000 increase in assets of the Laclede Gas Light Company between 1925 and 1926 by saying:

"The company claimed a $66,000,000 valuation before the Public Service Commission. In 1926 the commission gave a valuation in excess of the value carried on the books so we instructed the auditor to take the valuation as found by the commission and start the capital account from that point."

Swope on Advisory Board

Among those selected by Secretary Roper to aid Gen. Hugh S. Johnson in the administration of the national recovery act is Gerard Swope, president of the General Electrical Company. Two distinct groups of advisers to the administrator are provided for, the Industry Advisory Board and the Labor Advisory Board, and it is to the former group that Mr. Swope has been appointed.

New York Utilities on Commission Grill

New York's Public Service Commission, off on a little scandal-seeking expedition of its own, has been delving with varying degrees of sensationalism into the records of utility companies.

Tackling the Long Island Lighting Company, there was developed in the testimony of Russell F. Van Doorn, vice-president, the statement that the Long Island Lighting Company had paid $100,000 in premiums on the life of President E. L. Phillips.

Mr. Van Doorn stated that the money was paid by the Long Island Lighting Company on the $400,000 life insurance policy of Mr. Phillips, although E. L. Phillips & Company, a Manhattan engineering concern, of which he is also president, was named beneficiary. The premium was paid from 1926 to 1930 inclusive.

Asked how the lighting company would benefit, the witness said the money paid was "for the protection of E. L. Phillips & Co.," as the "continuity of the business of the contracting company" was essential to the Long Island Lighting Company.

Fire insurance premiums on the $500,000 Phillips mansion at Plandome, L. I., were also paid by the Long Island Lighting Company, as well as taxes of $10,000 in 1928 and $11,800 in 1929, it was testified.

Mr. Phillips subsequently denied that the Long Island Lighting Company had paid for his life insurance, or had paid taxes and interest, or other similar items, on his Long Island estate, in spite of Mr. Van Doorn's testimony.

New York Edison salaries

In the case of the New York Edison Company, also subjected to the spotlight of sensationalistic investigation, it was developed through figures introduced into the record that salary totals to principal officers had increased during the depression, while the total payroll had fallen off through the reduction in construction forces. The hearings, part of a general investigation of rates in the metropolitan area, will be continued. Company witnesses have requested the opportunity to further consult their records.

▼

Stamford Smoke Suit Settled

For $22,000 the Stamford (Conn.) Gas & Electric Company has settled with Pacific Street property owners during the past week suits for damage by smoke and soot for which more than $150,000 was originally asked by nineteen property owners (ELECTRICAL WORLD, June 10, page 743). Two owners withdrew their suits and Judge O'Sullivan had ruled the other seventeen would have their individual cases heard separately before a jury. Witnesses for the plaintiffs testified mainly that it was impossible to keep their homes clean because of smoke and soot from the power company's plant. Movement for settlement was made as the defendant company was about to offer testimony.

Along the Road to Yesterday

America's little experiment in applied metaphysics — that of turning back the universe to give us yesterday — is proceeding rapidly. With 1926 as the goal of retrogression, it may be properly considered that in the matter of general trade volumes we have returned to 1931. Automobile production, power output, lumber industry activities, steel mill reports — all point to early or mid-year levels of two years ago. To put it differently, about 40 per cent of the losses sustained between the 1929 peak and the extreme lows of 1933 have been recovered. Prices have not gone back so far. Grains, textiles and non-ferrous metals are priced better than in 1931; foods, fuels, building materials, chemicals and iron and steel are lower. Wage increases are beginning to appear; 5 to 10 per cent of the nominal rate.

Security and commodity markets now show some definite indications of a halt in the broad advance in spite of official pronouncements designed further to destroy confidence in the once-reputable American dollar. Not only is the Great Illusion to be pushed at home but our delegates to the World Economic Conference are to back the escape plan for other nations. Chief-of-the-Brain-Trust Moley is making a special trip to Europe to refresh their memories.

One is reminded of the remark attributed by merry wags to Henry Ford, in the days when the Model T was dark while other cars were yielding to color; by the dictum of General Johnson in connection with industry codes: "You may have any color you want," Mr. Ford was quoted as saying, "so long as it is black." "It is not the function of the Administration to prescribe what shall be in industry codes," says General Johnson, "but every code shall provide for collective bargaining, freedom to union membership by all workers and such maximum hours of labor and minimum rates of pay as shall be approved or prescribed." Such is one base of the new era.

▼

Indiana Governor Urges Municipal Plant Building

Urging that many hundreds of workers could be employed by increased adventures into and expenditures for municipally owned utilities, Gov. Paul V. McNutt of Indiana has indicated that his administration favors such action as a way out of the depression. In an address before 500 local government officials last week Governor McNutt showed how this could be made an integral and important part of the $50,000,000 public works program of the state. The plan is to have the program underwritten and 30 per cent financed by the federal government.

Chairman Perry McCart of the Indiana Public Service Commission told the audience how such a plan might be placed in effect and warmly praised the scheme as offered by the Governor. Mr. McCart maintained that such projects would have to be upon a self-liquidating basis. A call for plans to be submitted by various communities within 30 days was made.

▼

Lightning Causes Shut-Downs

Baltimore was in virtually complete electrical shut-down early last week when the 220-kv. transmission lines from Safe Harbor went out in a severe lightning storm and difficulties at the Westport station of the Consolidated Gas, Electric Light & Power Company led to successive shut-downs of street railway, residential, almost all industrial and some commercial service. Interruption was for about seven minutes. According to E. D. Edmonston, general superintendent, this is the first difficulty encountered with the Safe Harbor lines since they went into operation a year and a half ago.

▼

Cleveland Illuminating Restores 40-Cent Dividend

Probably the first of the electric light and power companies to feel enough of the upswing in business and earnings to permit reflection in increased disbursement to shareholders, the Cleveland Electric Illuminating Company has restored its dividend to a previous basis.

Dividend on the common stock, reduced to 30 cents a share three months ago, has been restored to the 40 cents a share base effective with the payment due July 1 to shareholders of record June 20.

▼

General Electric Wage Increase

Keeping pace with the recent flood of wage increases announced by various industries in response to the program of the Administration to raise workers' income, General Electric has introduced a 5 per cent pay increase. This will affect 50,000 employees in plants throughout the country. General Electric has met the successive stages of the depression by a 10 per cent wage cut, part-time weeks, unpaid vacations, etc. The increase is to be effective July 1.

Coming Meetings

American Institute of Electrical Engineers—Summer convention, Chicago, Ill., June 26-30. H. H. Henline, 33 West 39th St., New York.

American Society of Mechanical Engineers—Chicago, Ill., June 26-30. C. W. Rice, 29 West 39th St., New York.

American Society for Testing Materials—Chicago, Ill., June 26-30. C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

Engineers' Day, Century of Progress Exposition—Chicago, Ill., June 28, G. E. Pfisterer, 308 West Washington St., Chicago.

Illuminating Engineering Society—Delavan, Wis., August 28-31. D. W. Atwater, 29 West 39th St., New York.

International Association of Electrical Inspectors—Chicago, Ill, September 11-15. V. H. Tousley, 612 No. Michigan Avenue, Chicago.

National Association of Railroad and Utilities Commissioners — Cincinnati, Ohio, October 10-13. James B. Walker, 270 Madison Ave., New York.

Association of Iron and Steel Electrical Engineers — Pittsburgh, Pa., October 17-19. John F. Kelly, Empire Building, Pittsburgh.

▼

International Conference Meets in Paris, France

No fewer than 31 countries, with a total of nearly 700 registrations, took part in the International Conference on High Tension Distribution Systems which met in Paris this week. The work of the conference was divided into three main sections—generation and distribution, transmission line construction and insulation and operation and protection of distribution systems. Approximately 122 reports and papers were submitted to the various meetings.

American contributors included: H. W. Young and Joseph C. Rah with a paper on "Some Tests on High-Tension Cables," A. O. Austin on "Routine Tests of Insulators" and also on "The Determination of a Security Index for Electric Power Transmission Lines" and "The Mass Production of Insulators." W. W. Lewis contributed "The Effect of Lightning on Transmission Lines and Central Power Stations."

▼

Electric Hotbeds Advance Profits in Vegetables

As reported by the agricultural engineering and horticultural departments of Purdue University the use of electric hotbeds not only provides better and faster germination of seeds but has other advantages.

In comparative tests, it is reported, electrically heated beds have brought tomato plants through the ground in six days as against sixteen days for the manure-heated bed, while the electric way brought egg plant to the surface in seven days as against fifteen days in the manure bed.

Bigger profits are available, too, for in one instance a grower, through the fast start his tomato plants secured in the electric hotbed, was enabled to sell tomatoes out of the field at 8 cents a pound in direct competition with hothouse growers and imported products. In addition to providing faster and more abundant growth, the electrically heated bed also seems to provide more complete germination. In a test of tomato seeds the electric bed produced 83 per cent germination as against 69 per cent in a steam-heated bed.

The cost of current may be less than that of manure. Ten installations throughout Indiana, installed under supervision of Purdue officials, used an average of 1.6 kw.-hr. of electric current per day for each sash. With power priced at three cents a kilowatt-hour, the current cost varied from two cents a day for each sash, depending upon whether the bed was well banked and sheltered and whether it was covered at night. The majority of the installations had an energy cost of less than 4 cents a day for each sash.

Although the hotbeds may be operated satisfactorily and economically by using a manually operated switch, a thermostat reduces the amount of supervision necessary in order to maintain uniform temperatures and will also frequently result in a saving of electricity, particularly on warm days.

▼

Canadian Group Discusses Load Building

PROBLEMS similar to those before the electric utility industry of the United States face the Canadian electric light and power companies if the discussions at the 43d annual convention of the Canadian Electrical Association at Lucerne-in-Quebec last week offer a fair example. Load building was seen by many speakers as both the dominant problem of the industry in that country and as the one way out of the difficulties into which the business under various attacks and developments has drifted. This topic also took an important place in the engineering discussions.

Association President Parker, of the Gatineau Power and Gatineau Electric Light companies, in reviewing the year's activities pointed to the problems which the Canadian Electrical Association, long-affiliated with the National Electric Light Association, faced following the dissolution of that organization and voiced regret at the difficulties involved in establishing similar relationships with the Edison Electric Institute. Some form of affiliation is anticipated.

Taxes have absorbed much effort and attention in Canada and of these Mr. Parker stated:

"Looking back over convention reports for twenty years, I find that taxation has been an ever-recurring topic for discussion. The depression through which we are passing has brought home to the whole world, as never before, the heavy weight carried by industry and the consuming public as their share in carrying the cost of government.

"I do not think that any privately owned public utility objects to carrying a fair share of the cost of necessary government. As the burden increases, however, in the endeavor for public bodies to secure additional federal, provincial and municipal revenues, the discrimination resulting when rates of publicity and privately owned utilities are compared becomes more and more marked and is a very unnatural and unfair handicap to private industry . . . the hope for redress seems to lie in arousing public consciousness by passing on taxation levies directly to the consumer as a specific charge on the monthly bill. This is already being done with regard to municipal levies.

"Considerable progress during the past year," President Parker reported, "was made along the lines of load building. The use of electric-steam generators is not new to Canada. During the past year several large installations have been made and this use of large blocks of electrical energy which may be recovered when required for other industries will go a long way in tiding over the condition of overproduction which exists in some sections.

"While industrial loads have fallen

The constant criticism of the gold standard is merely an effort to lift from the shoulders of men the mistakes which they have made and shift them upon an inanimate thing.

A seeming prosperity, honeycombed with unsound practices, was built up during the years of 1919 to 1929, and the world had to reap what it had sown.

The fact that every attempt to carry on a managed currency has failed is not appreciated by the masses. The word "inflation" carries to every individual a picture of a people, each and all of whom have plenty of money.

There are just two ways in which money can be obtained by the people; one is for them to earn it, in which case the depression would be over, and the other is to have it given to them.

Inflation that means the distribution of gifts may carry a temporary stimulation to business, but it will be followed by the activity of the inevitable forces of destruction which have been the aftermath of all such attempts to meet financial problems throughout history.

FRED I. KENT.

[**Mr. Kent addressed the thirteenth annual convention of the American Institute of Banking last week in Chicago, his topic being "Sound Money."**]

off to some extent, steady progress has been made in all provinces in the application of electricity to domestic purposes; 1933 will register a very marked advance in many quarters due to the exceptionally advantageous sales schemes being worked out for such load-building appliances as water heaters. It would appear that a new era in the merchandising of load-building appliances has been inaugurated in Canada.

"The engineering aspects of the utility business have not changed greatly except as better ideas for system assembly and system layout reduce investment and operating costs. Studies have been made leading to a more general interchange of power between utilities by means of the network principle and this will evidently lead to improvement in system load factors and ultimate economy in plant investment.

"We can discern nothing in the next decade," concluded Mr. Parker, "which indicates any limitations upon the continued growth and use of electricity. On the contrary, the whole trend of technical development seems to confirm the general impression that electricity is only beginning its real service to mankind. So far as anything can be certain, in these very uncertain times, the electrical industry will take a foremost place in the development of Canada for many years to come."

Heat uses increase

R. J. Beaumont of Shawinigan Water & Power Company related successful efforts to increase the load of one of the larger Canadian utility companies. He outlined plans to increase consumption through the sale of water heaters and hot-beds and the rental of ranges which showed an actual 50 per cent increase in installations in two months over the previous twelve months. Other valuable sources for the development of load lies in the heating of buildings by electricity and through increased lamp sales.

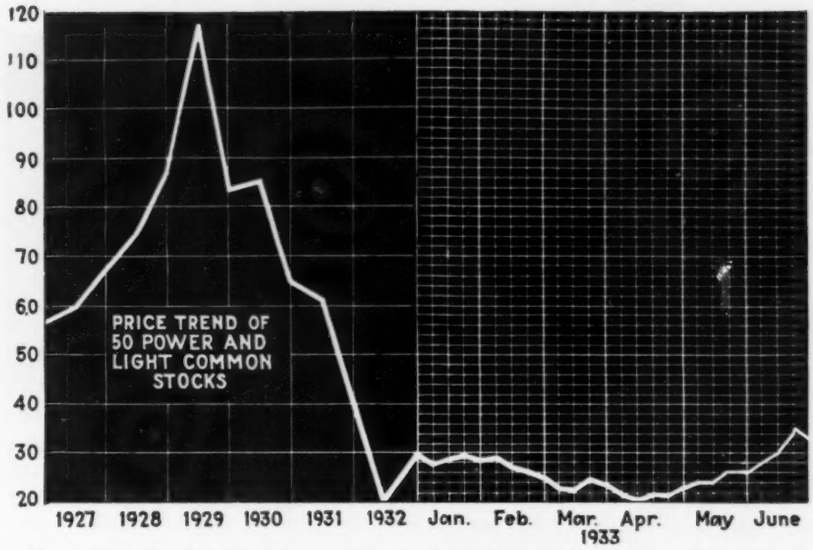
A. S. Edgar of the Canadian General Electric Company, Ltd., pointed the way to increased sales through "ensemble selling of merchandise." Mr. Edgar outlined the tremendous possibilities in increased load when a house is completely equipped in line with modern standards. It was pointed out that the kitchen in a house with normal equipment means an annual revenue of $58.59 per year, on a rate of 2.25 cents per kilowatt-hour, the national average in Canada, while complete modern installation raises it to $72.99.

Taking the home as a whole, normal equipment produces a revenue of $78.85 per home, while modern equipment raises this amount to $167.60. Mr. Edgar stated that about 88 per cent of the possible domestic market in Canada still awaits development and that the newest efforts of the manufacturers to open this market is through "ensemble" selling, the aim of which is to present to the prospects a picture of the complete electrical kitchen, the complete electrical laundry, or even the complete electrical home.

The report of the electrical apparatus committee was responsible for a long and interesting discussion of the value as a load builder of heating houses by electricity. This committee presented a report which covered data from 31 residential heating installations in service in eastern Canada (ELECTRICAL WORLD, June 17, page 780).

Elections for the season 1933-34 included: President, Alex D. Robb, Canadian Niagara Power Company, Ltd.; vice-presidents, John Morse, Shawinigan Water & Power Company; R. B. Baxter, Calgary Power Company, Ltd., and E. H. Adams, British Columbia Electric Railway Company, Ltd.

Utility Stock Rise Interrupted



For virtually the first time since last April, barring minor changes, the "Electrical World" average of utility stock shows a setback. This week 32.7; last week 35.0.

▼ ▼ ▼

Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
Detroit Edison (Year ended May 31)					
Gross earnings	$41,461,163	$47,042,675	—11.9	71	67
Net earnings	11,809,824	15,525,748	—23.9	..	..
Net balance	5,401,453	9,524,838	—43.2	..	..
Duquesne Light (Year ended March 31)					
Gross earnings	24,354,755	27,188,072	—10.4	44	42
Net earnings	13,637,726	15,765,884	—13.5	..	..
Net balance	9,755,396	12,165,381	—19.8	..	..
Northern States Power (Del.) (Year ended March 31)					
Gross earnings	31,631,814	33,934,827	— 6.8	60	57
Net earnings	12,565,437	14,734,040	—14.7	..	..
Net balance	1,585,130	3,843,729	—58.5	..	..
Northern States Power (Minn.) (Year ended March 31)					
Gross earnings	27,735,914	29,754,426	— 6.7	63	58
Net earnings	10,295,881	12,285,126	—16.2	..	..
Net balance	6,809,154	8,884,984	—23.4	..	..

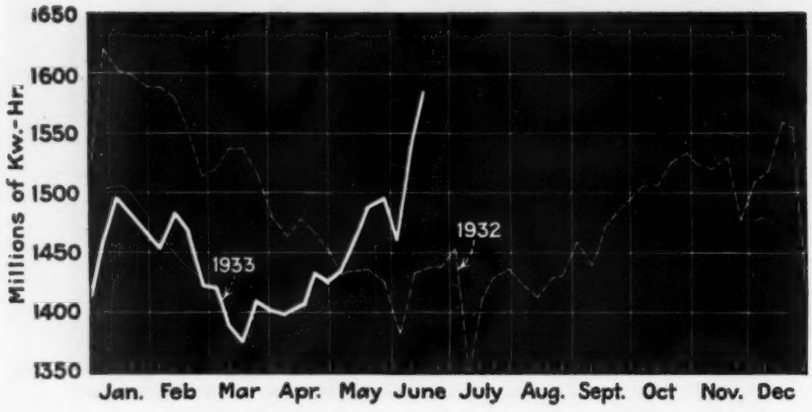
Holding Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
American Water Works & Electric and subsidiaries (Year ended April 30)					
Gross earnings	$42,092,109	$48,092,830	—12.5	56	55
Net balance	1,691,003	4,665,189	—63.5	..	..
Continental Gas & Electric and subsidiaries (Year ended April 30)					
Gross earnings	30,934,534	30,870,638	0.2	65	64
Net balance	1,492,454	3,095,349	—51.7	..	..
Philadelphia Company and subsidiaries (Year ended March 31)					
Gross earnings	46,981,340	55,026,096	—14.6	65	61
Net balance	4,015,421	8,790,271	—54.5	..	..
United Light & Power and subsidiaries (Year ended April 30)					
Gross earnings	75,124,524	84,833,071	—11.5	67	65
Net balance	936,778*	3,389,724	—172.5	..	..

*Deficit.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings — Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net balance — Balance available from income for common stock dividends.

Production Mounting Rapidly



During the week ended June 17 the output of electric light and power stations, which has been mounting rapidly during the past three months, increased further to 1,578,101,000 kw.-hr., according to the Edison Electric Institute. This constitutes an increase of 2 per cent over the preceding week and brings the excess over 1932 to 9.5 per cent, compared with 7.4 per cent for the week of June 10.

In addition to being the largest thus far in 1933, the latest production figure overshoots anything in 1932 except during the first few weeks. The output in New England surpassed last year's at this time by 18.2 per cent and in the Central industrial area by 11.9 per cent.

Weekly Output, Millions of Kw.-Hr.

Week ended	1933	1932	1931	1930
June 17.....	1,578	1,442	1,610	1,698
June 10.....	1,542	1,435	1,621	1,707
June 3.....	1,461	1,381	1,594	1,657
May 27.....	1,494	1,425	1,602	1,660
May 20.....	1,483	1,436	1,645	1,723

Per Cent Change from Previous Year

Region	Week Ended June 17	June 10	June 3
New England alone.....	+18.2	+14.5	+12.1
Middle Atlantic.....	+ 7.0	+ 7.2	+ 7.1
Central industrial.....	+11.9	+10.0	+ 7.3
Southern States.....	+13.6	+10.9	+12.9
Pacific Coast.....	— 1.4	— 5.3	— 2.3
United States.....	— 9.5	+ 7.4	+ 5.8

▼

Missouri Board Upheld by State Supreme Court

Refusal of the Missouri Public Service Commisison to permit the Union Electric Light & Power Company of St. Louis to acquire and hold 26 per cent of the capital stock of the Laclede Power & Light Company (ELECTRICAL WORLD, January 21, page 85) has been sustained by the Missouri Supreme Court.

This decision affirms the ruling of the Cole County Circuit Court, which also upheld the state commission. The commission rejected the request of the Union Electric company for an interest in the Laclede company on the grounds that the result would be adverse to public interest. Union Electric officials had stated that the purchase of the Laclede Power & Light stock would be the opening wedge to obtain control of the smaller company. Referring to this the opinion of Division No. 1 of the Supreme Court reads:

"We think the commission might be justified in considering this simile as indeed very apt. We understand a wedge to be an instrument for splitting some other things wide open."

Touching on the contention of Union Electric that a monopoly would prove more efficient and economical, the decision reads:

"That might be true in a sparsely settled section, but whether it is true in a great metropolitan area like St. Louis is another matter. It also might be better from the standpoint of profit for the North American family (North American Company controls Union Electric), but whether it would, under the situation now existing, be better for the people of St. Louis is, likewise, another matter. These are questions for the commission to decide.

"Theoretically, an absolute monarchy is the most efficient and economical form of government. As a practical matter, however, the lessons of history show that human nature is not strong enough continuously to withstand the strain of temptations which come with absolute power."

It then added the court was of the opinion that it was not the purpose of the Public Service Commission act to place each form of public utility under the control of one corporation, although admitting it was the commission function to restrain cut-throat competition, on the theory it was destructive and that the public must pay for such destruction.

Laclede Power & Light is controlled by the Utilities Power & Light Corporation of Chicago, which also controls the Laclede Gas Light Company of St. Louis.

Louis H. Egan, president of Union Electric, has a suit pending in the St. Louis Circuit Court to force Laclede Power & Light to recognize him as a director under votes cast by the holders of the voting trust certificates the Union Electric seeks legally to own.

The request of Union Electric to acquire and hold the Laclede stock was rejected by the state commission in April, 1922, but the company appealed from that ruling to the Cole County Circuit Court and then to the Supreme Court. It now has an opportunity to file a motion for a rehearing.

▼

British Electricity Board Floats $32,000,000 Issue

Adding to the £36,000,000 of its stock now in the hands of the public, the British Central Electricity Board made a public offering of an additional £8,000,000 early this month at the rate of 3½ per cent and at a price of 93½. Stock now outstanding, and with which this issue rates *pari passu,* bears returns of 4, 5 and 4½ per cent. So popular are electrical investments in England at present that not only was the issue offered to yield an unusually low return, but the books were left open to subscription less than one day.

"Stock" in British finance may, as in the case of these issues, bear definite interest rates and have definite terms for existence. The present issue matures in 1993.

▼

British E. D. A. Plans Changes to Become Trade Association

Proposed changes in the constitution of the British Electrical Development Association to take the form of amended articles of association are to be placed before an extraordinary meeting of the association at an early date.

As recommended by the E.D.A. Council, membership would be restricted to authorized electricity supply undertakings, the Central Electricity Board would be admitted to membership, a new council to be composed of members of the central board, municipal plant members and members of joint projects would be formed, and manufacturers, as in the case of our own Edison Electric Institute, would not be eligible for membership. The plan is said to be patterned to some extent after that of E.E.I., but without some of its more rigorous provisions as to member conduct.

Indoor Sodium Lamps Have Been Developed

Sodium-vapor lamps are proceeding to further development and refinement along several lines. What is said to be the first public installation of such equipment indoors was demonstrated by Westinghouse engineers before the New Jersey Industrial Conference at Andover, N. J., last week. These sources operate on alternating current and each lamp, while rated at 60 watts, produced the light equivalent of a 200-watt incandescent type source.

In discussing these lamps John W. Marden of the Westinghouse Lamp Company pointed out:

"Though representing a vast step forward in the design of artificial light sources because of its high efficiency, which is in the order of 40 to 60 lumens per watt as compared to 15 lumens per watt for an ordinary tungsten-filament lamp, the effect of the yellow light from the sodium lamp may make it unsatisfactory with color playing such a large part in our daily living habits.

"One could hardly expect the housewife of today to adopt a lamp for its high efficiency and cheap operation when it would turn her gayly colored kitchen or bathroom into a drab, lifeless room, uninviting to the eye. Yet in a room decorated with black and gold, as perhaps in hotel lounging areas, the yellow light would lend a fascinating sheen to the decorative motif. Possibilities in the same direction might eventually prove valuable for spectacular effects on the stage.

"Metal vapor lamps will no doubt have considerable influence on the lamp industry in the future, but they will never displace the tungsten-filament lamp any more than the airplane has replaced the automobile.

"The sodium lamp has greatest possibilities for that type of illumination under which the eye must observe precision operations, since the strong monochromatic yellow light permits the eye to function more efficiently and restfully over a long period. Any immediate application of sodium light in industry, however, will probably occur where the color effect is not objectionable and where the handling of small objects or close inspection work requires high visual acuity."

▼

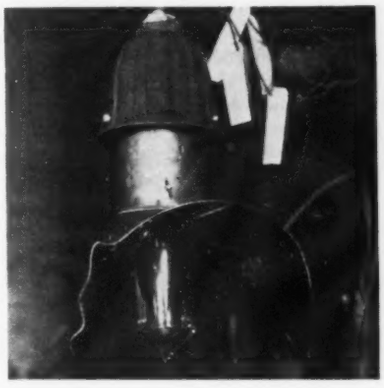
One-Year Test for Kootenay

Tentative agreement providing for a one-year test of water storage plans in the Kootenay River has been reached by the West Kootenay Power Company of British Columbia and the settlers in the Kootenay Valley of northern Idaho, according to the announcement of Attorney-General Bert Miller. Settlers in the Kootenay Valley had protested the plan of the power company to store water in the area with a dam in the Kootenay River because of their fear that their drainage districts would be imperiled. The question has been considered by an international joint claims commission meeting at Spokane, Wash. At this meeting the power company proposed the one-year test.

▼

Sodium-Vapor Lamps Used on Half Mile of Highway

Sodium-vapor lamps for street lighting, long since spectacularly installed in Holland (ELECTRICAL WORLD, August 20, 1932, page 233) and England (November 26, 1932, page 713, and April 1, 1933, page 409) have at last achieved practical application in the United States. For ½ mile along the Balltown Road, near Schenectady, N. Y., General Electric engineers, in collaboration with those of the New York Power & Light Corporation, have installed 22 lighting



units, not more than eighteen of which will be lighted at any one time. These have been so placed that they may be demonstrated in spacing combinations of 125, 250 or 500 ft.

Most important of the advantages of this type of source is the comparatively high efficiency afforded. They can be manufactured with two to three times the efficiency of the tungsten-filament incandescent lamp and there are indications that even greater efficiencies will be obtained eventually.

The lamps just placed in service are equipped with a special type of reflector, resembling a "floppy bonnet," designed to put the light on the road rather than to distribute it in all directions. By means of a photoelectric control they are turned on automatically when darkness falls.

Makes seeing easier

The arc in these lamps has the appearance of a neon discharge, somewhat red in color, when the current is turned on. As the lamp is warmed by its heater element, and the arc and the pressure of the sodium increases, the light becomes yellow. At first glance the light from the new lamps seems markedly dim in comparison with incandescent or arc lamps, but seeing is actually made easier by the reduced glare and the monochromatic quality of the light. Sodium lamps for the same wattage input give about 2½ times the light output of the incandescent lamp. This fact, together with the improvement in vision under monochromatic light at low intensities, indicates a great increase in visual efficiency over the present-day highway lighting systems, without an increase in current consumption. This will be partly offset by increased installation expense.

The lamp itself is a gaseous discharge device, mounted within a "thermos bottle" to conserve heat and maintain the sodium at about 480 deg. F. It is 7 in. long and less than 3 in. in diameter and fits closely within the "thermos" globe. The lamp wattage is about 80 to 90 and the light output about 4,000 lumens, equivalent to the 400-cp. "Mazda" lamp, which consumes 215 watts.

▼

Major New Construction This Week

Kansas City, Kan., has authorized plans for first section of underground transmission system to cost $175,000. Plans for other sections will follow at early date. Total cost $500,000 with conduits, cables and accessory equipment.

Heavy-duty motors, controls, pumping machinery, etc., will be installed by Canfield Oil Company at Coraopolis, Pa. Cost about $100,000.

Pelican Brewing Company, New Orleans, La., plans brewery with power station adjoining. A $250,000 project.

Motors, controls, transformers, conveyors and loaders will be installed in city-owned incinerator plant at Cleveland, Ohio. Bids to be asked in July. Cost about $700,000.

Hyde Park Breweries Association, Inc., St. Louis, Mo., will remodel and equip Hyde Park, Lafayette and Wainwright plants at cost of about $500,000.

Motors, controls, conveyors, etc., will be installed in shatterproof sheet glass plant of Libbey-Owens-Ford Glass Company, Toledo, Ohio. Cost $100,000.

Machine drives, motors, controls, etc., will be installed in Los Angeles, Calif., paint and varnish plant of Pittsburgh Plate Glass Company. Cost over $100,000.

Crescent Brewing Company, Joplin, Mo., plans brewery with electric refrigerating unit. Cost over $300,000.

New York Metal Prices

	June 13, 1933 Cents per Pound	June 20, 1933 Cents per Pound
Copper, electrolytic	8.00	8.00
Lead, Am. S. & R. price	4.20	4.20
Antimony	6.50	6.50
Nickel ingot	35.00	35.00
Zinc, spot	4.65	4.65
Tin, Straits	45.25	44.625
Aluminum, 99 per cent	23.30	23.30

As to Rates——

• In a cross-petition filed recently by the Birmingham Electric Company increase of street car fare from 7 to 10 cents is asked in the event of the Alabama Public Service Commission's deciding to order a decrease in the company's service rates (ELECTRICAL WORLD, June 10, page 745). Opposition to severance of the electric and transportation divisions of the company for rate-making purposes is voiced in the petition.

• Investigation into the rates and rate structures of the Syracuse Lighting Company, the Buffalo General Electric Company and the Niagara, Lockport & Ontario Power Company has been ordered by the New York Public Service Commission.

• In a decision handed down by Justice Schenck of Albany, N. Y., the Rockland Light & Power Company has been granted a stay against an order of the commission directing it to file a temporary schedule of reduced rates, pending final adjudication of a rate case pending in the Appellate Division. Public utility rate experts have expressed the opinion that the ruling would block the Public Service Commission in its plan to order temporary rate cuts throughout the state. Commission views differ from those of utility executives. It was pointed out on behalf of the commission that the decision specifically refrained from passing on the merits of the commission's order in the Rockland case, since that order was under review by the Appellate Division. It merely held that a stay would be granted against the temporary rates because of errors on the part of the commission in considering certain evidence at hearings.

• In a presentment to Supreme Court Justice Edward Riegelmann the Queens County (N. Y.) grand jury has recommended that Governor Lehman bring about a legislative inquiry into utility operations and rates, with special reference to New York City. The grand jury, whose investigation lasted two months, found that "perhaps we are not entirely justified at this time in asserting that utility rates in Queens County are too high." The presentment found that rates had not decreased from the 1929 peak, although commodity costs of the companies serving Queens had dropped by 40 per cent and wages had been lowered. Governor Lehman was urged to call a special legislative session to act upon the utility situation.

• On the ground that revenues have decreased, taxes have increased and bid fair to be still greater, and that managerial expenses if cut in half would have little effect on dividends, the Massachusetts Department of Public Utilities last week issued a finding dismissing the petition of customers of the New Bedford Gas & Edison Light Company for lower rates for gas and electricity. In a dissenting report Commissioner Webber attacked the management contracts in force between New Bedford Gas and servicing companies of the Associated Gas & Electric System.

• Renewed demands for an immediate cut of 10 per cent in electricity rates and for an appraisal of the Detroit Edison Company's properties on which to base new rates will be made under a resolution adopted by the Detroit City Council. The request will be directed to the Governor, Attorney-General and Public Utilities Commission of Michigan.

• Central Power Company of Nebraska has asked the federal court to enjoin the Council of Nebraska City from enforcing new schedules of rates for electric energy, gas and water service, which it asserts to be confiscatory and if in operation for the last year would not have yielded net income sufficient to meet its bond interest.

• Present electric rates charged by the Union Gas & Electric Company, Cincinnati, will prevail until September 15 if Council enacts an interim rate ordinance introduced by the chairman of the public utilities committee. Present ordinance expires June 30, but representatives of the Burns & McDonnell Engineering Company, who are compiling data and obtaining facts which will enable them to recommend a new rate (ELECTRICAL WORLD, March 18, page 344), have not yet completed their work. The ordinance recently introduced, extending the present rates from June 30 until September 15, has been referred to the public utilities committee of the city Council.

Illinois dividend cuts

• Following the conference with James Simpson and George A. Ranney, chairman and vice-chairman of the Commonwealth Edison Company, the Peoples Gas Light & Coke Company and the Public Service Company of Northern Illinois (ELECTRICAL WORLD, June 17, page 784), Benjamin F. Lindheimer, chairman of the Illinois Commerce Commission, has announced that reduced rates on electricity and gas in Chicago and suburbs will become effective July 1. The amount of the reduction was not given, Mr. Lindheimer explained, because the utilities offered a reduction of approximately $4,000,000 a year, based on 1932 business, and the commerce commission asked for a much greater reduction.

• Dividend cuts of not more than 20 per cent in the case of Commonwealth Edison and Peoples Gas Light & Coke companies and of at least 20 per cent in the case of Public Service Company of Northern Illinois were assured according to statements by management as the result of the aggregate annual revenue loss of $4,549,036 which those three organizations will suffer through the rate cut plan to be made effective July 1. As the Illinois Commerce Commission and the utilities were unable to agree on a final reduction the companies' offer of a 3 per cent slash is to be put into effect temporarily.

Tennessee slash protested

• Tennessee Electric Power Company has filed a protest with the State Railroad and Public Utilities Commission to the recent order reducing rates for residential lighting in some 250 municipalities of Tennessee (ELECTRICAL WORLD, June 10, page 745), but advises the commission that "while taking exception to the order and filing this protest, it will attempt to operate its property under the rates as set out, reserving, however, all of its rights under the Constitutions of the State of Tennessee and of the United States of America to have a hearing in this matter and to have the rates changed or revised so as to produce the revenue which the company is entitled to earn on its property used and useful in the public service." The company asserts that "the revenues of this company are not at this time producing a reasonable return."

• Investigation of street lighting rates in the cities and towns of the State of Washington has been instituted by E. K. Murray, director of the state Department of Public Works. It is hoped to establish uniformity in rates and to eliminate alleged discrimination.

• An appropriation of $100,000 has been asked by the New Jersey Board of Public Utility Commissioners for an investigation of the rates charged by electric and gas utilities of that state. Thomas N. McCarter, president of the Public Service Corporation of New Jersey, in defending the charges of the electric and gas company, pointed to numerous reductions since 1924, and stated: "If we are to have a rate case, the company will be prepared to contest it to the end."

• Offer of an 8 per cent rate reduction for Wabash, Ind., instead of the 15 per cent for which the Mayor has been contending, has brought city officials back to the discussion of a possible municipal plant. Wabash is served by the Northern Indiana Power Company.

• Effective August 1, by order of the Massachusetts Department of Public Utilities, the Cambridge Electric Light Company will reduce its rates to domestic customers. In brief, the reduction takes the form of applying the present charge of 5 cents a kilowatt-hour to the first 75 kw.-hr. instead of the first 2,000 and of billing excess energy at 2.5 cents instead of 4 cents.

• Vigorous defense of the penalty charge imposed by Kansas City utilites was presented before the Missouri Pub-

lic Service Commission at hearings last week. C. C. Smith, vice-president Kansas City Power & Light Company, testified that his company lost nearly $3,000 last year in the collection of delinquent accounts and that the 10 per cent penalty imposed is only provided to reduce this expense. It cost $88,000 in 1932 to collect such items, Mr. Smith testified, while the penalty impost brought in but $85,000.

▼

Employees' Loan Plan Works

During the 6½ years that it has been in operation the General Electric Employees' Relief and Loan Plan has loaned $565,600 to members, of which a total of $465,900 has been repaid. Loans now outstanding amount to $99,700 and repayments are being made by deductions from the wages of members when working.

▼

Missouri Hydros Opposed

Missouri Association of Municipal Utilities at its annual convention unanimously approved a resolution in opposition to the construction of hydro-electric dams and power plants on any Missouri rivers and the Missouri General Assembly was requested to take steps to "preserve the economical and æsthetic values of water-power sites in Missouri against wasteful and speculative exploitation by private interests." The state lawmakers have also been requested to enact legislation requiring a two-thirds majority vote in cities of all classes in the granting of any franchises to privately owned and operated public utilities.

▼

Would Settle Abitibi Claims

Instructions have been issued by the Ontario government to the Hydro-Electric Power Commission to negotiate with any creditor having a claim outstanding against the Ontario Power Service Corporation, whose unfinished Abitibi Canyon power development has been taken over by the province. Total of such claims is reported to range between $4,500,000 and $5,000,000.

▼

Georgia Power Shortens Week

All employees of the Georgia Power Company have been placed on a five-day week basis, it is announced by Preston S. Arkwright, president of the company. The five-day week, in effect some time with the street railway and other "operating" departments of the company, has been extended to the offices of the company. Stores in all parts of the state will be closed all day Saturdays under the new arrangement.

▼

Electric Lights Bejewel St. Peter's

International

Thousands of electric incandescents outlined St. Peter's Cathedral in Rome during the impressive ceremonies this month which marked the canonization of André Hubert Fournet. Thus once more have modern facilities assisted in the drama and pageantry that ever effectively is used in connection with religious ceremonies. An audience of more than 50,000 persons attended this spectacle.

"Show Train" for England

Not to be outdone by the "42d Street Special" (ELECTRICAL WORLD, March 25, page 375), England has adopted the "show train" as a method of popularizing new lines of appliances and of bringing the story of electricity to the hinterlands. Off on a three months tour of Britain, beginning late in May, went the three-car train of J. S. Fry & Son resplendent in blue and gold. One car serves as a showroom, another as sleeping quarters for employees and the third as a storeroom and source of electrical energy supply.

▼

Canadian Electrical Facts

According to the news letter of the Canadian Electrical Association, electric-steam generator installations in the Dominion total 1,365,000 kw. at present. The total value of power so consumed approximates $2,888,000 a year. Canadian generating stations produced 1,295,081,000 kw.-hr. in April of this year. Exports amounted to 35,272,000 kw.-hr.

▼

Utility Wins Tampering Suit

Settlement of a meter-tampering case has been effected in the Circuit Court at Salem, Ind., through a jury verdict in favor of the defendant in a suit for $1,000 damages by Roy Wayman against the Public Service Company of Indiana. Plaintiff alleged inconvenience and humiliation resulting from the removal of an electric meter from his home by the utiltiy and suspension of service until he paid for the damage to the meter and an estimated charge for electricity unrecorded by the meter. The company claimed that when the meter was removed employees found specific evidences of tampering.

▼

Granite City (Ill.) Municipal

Contracts for a preliminary survey of plans to establish a municipal light and power plant and distribution system in Granite City, Ill., have been entered into by the Granite City Council. The Council contemplates financing by the issuance of certificates or bonds against the plant and revenue so that the general public debts of the community will not be increased. A self-liquidating loan from the Reconstruction Finance Corporation is also under consideration. Voters of Granite City at the municipal elections held on April 4, 1933, approved a proposal that the city construct, maintain and operate its own water works and light and power plant, but funds for the financing of the projects were not voted at that election. The franchise of the Illinois Power & Light Corporation for supplying electricity in Granite City does not expire until 1936.

EDITORIALS

L.W.W.MORROW
Editor

The government as a partner

WHAT is the executive partner of industry going to do with his big stick? Shall the electrical industry rush to Washington and grab hold of the stick, either in fear or in expectation of having it used to its advantage, or shall it stay home and capitalize upon the present up-turn in business?

There is no necessity for precipitate action. More than 100 codes of practice have already been submitted to the administration or are ready for submission. The industrial recovery act is a labor act and the primary questions applied to each code will be: What is your minimum wage and your maximum hours of labor? Will you raise wages and will you employ more people under this code? Any industry that goes to Washington expecting to get approval of price agreements as a primary part of its code will be shown the door, politely but firmly.

Under these conditions and with a full recognition of the time required to administer the act for all industries there is no need for the electrical industry to be hasty in action or fearful of governmental interference. It is a relatively small industry and has splendid labor conditions. It needs more sales, and governmental intervention will not obtain them.

Manufacturers, wholesalers and retailers should appoint a joint committee at once, however, to draw up a code for the entire industry. There must be unity in this code for all these parties and the code should be specific as well as supported by data before it is submitted to Washington for approval. There should be no delay in starting this work.

While this necessary work is going on to cooperate with the government and to carry out the act the rank and file of the industry should go about their business and earn a greater prosperity. They should have no fear that drastic governmental interference will be had immediately so long as the industry continues to sell its markets and improve its standards of business conduct. Basic industries necessarily will serve as trial horses for the government to ride. In summary, therefore, it is our belief that the electrical industry should go to work at once to develop a sound and complete program for carrying out the far-reaching permissive powers of the act, but it should not permit the act to distract its attention from its markets or persuade it to rush to Washington with a hastily compiled and ill-considered program.

Kansas corrects its mistake on merchandising

RESTRICTIONS imposed against the sale of domestic appliances at retail by power companies in two states have just been removed. The Supreme Court of Kansas has ruled that the Kansas state law is unconstitutional, being in violation of the Fourteenth Amendment, since it discriminates against the public utility, in permitting others to merchandise and denying it that right. The court held that its franchise entitled a utility company to thus promote and further the development of its business. Also the state Appellate Court of Texas has dissolved an injunction, granted some time ago, against the San Antonio Public Service Company, forbidding it to sell electric and gas appliances. Here too the court held that the sale of load-building appliances is a proper function of the utility's business. In other words, calm judgment is beginning to assert itself in this matter and, as usual, "truth beareth away the victory."

Time is going to demonstrate that all the agitation against the merchandising of appliances by power and gas companies has been a grave mistake.

in which both sides have shared. Certain electric and gas utilities, inexpert in retail selling, established merchandising policies that were unfair to the local dealers who were competing with them. Exasperated at their inability to secure redress, these dealers started an agitation, through their national associations, and legislation was introduced in many states. Kansas and Oklahoma passed prohibitory laws. And when the power and gas companies quit merchandising the mail order houses and chain stores stepped in and grabbed the business at cut prices. The net result was that the dealers gained nothing and destroyed the most creative influence for market development.

All this is gradually being found out, and as it becomes more fully understood the right of the power company to build its load by merchandising domestic appliances will no longer be questioned. For it is more than a right. It is a responsibility. Without organized load building the market does not grow and the dealer's business languishes also. This places an obligation on the utility to go forward and develop the use of electricity in the interests of the trade and the public, as well as of its own stockholders.

To save the pedestrian

THE Massachusetts Safety Council will make pedestrian protection its major problem for 1933; recent analyses of accidents on highways by insurance engineers emphasize the perils of depending on headlights alone to pick up walking silhouettes after dark, and the appalling loss of life traceable to inadequate illumination in both city and country justifies carefully planned cooperative action against this grave menace.

Circumferential, by-pass, air-line and point-to-point highway construction automatically creates serious pedestrian problems which can be minimized or completely solved by street and roadway lighting fitted to local conditions of visibility, electrical supply and cost limitations. Traffic signals aid vehicular movement, but need to be supplemented for pedestrian protection by fixed lighting units at crossings, curves, hill crests and other places which traffic engineers designate as hazardous. It is not too late to start systematic work among the interested agencies if 1933 is to mark real improvement in the grievous accident record of its predecessors.

Economy may not dedicate high efficiency

BETTER efficiency is always a desirable goal in the abstract, but in engineering technique it has to be weighed in the light of its economic virtue. As a consequence the declining price for power over a long period of years and of materials and labor over the last three years raise the question whether 1929 efficiencies and design criteria are most appropriate for the price levels now in vogue. Shall the drive for higher efficiencies continue with the entailed higher relative cost of the design or shall lower efficiencies and lower costs follow the declining value of power saved by efficiencies which may be uneconomically high? There is some virtue in following the second alternative. This has little to do with decreased costs of fabrication as reflected by lower costs of labor and materials. It has lots to do with the optimum value of fixed and operating charges incurred by the user after he has made his purchase.

There have always been ways of making gains in efficiency without adding a neutralizing increment to cost. Application of these methods is what gives one product a superiority over another, assuming they are otherwise equal as to durability, ruggedness and maintenance costs. Among these, for example, is the opportunity to reduce dimensions by adopting designs and materials that afford the chance to realize on higher temperatures without increase in intrinsic losses, thus throwing all the competitive benefits into the category of initial cost and fixed charges. In other words, no gain in efficiency is attempted, but this possible benefit is foregone for the sake of cutting weight, size and cost.

One matter that offers just this chance is the rising importance of inorganic and synthetic insulations. There are available compounds, like cellulose acetate, which can stand without deterioration higher temperatures than fibrous materials like cotton or pressboard, can be made good from the hygroscopic and inflammable standpoint and can be given the dielectric value of mica. Perhaps even the bars of squirrel-cage rotors should be insulated with that type of material in order that the losses in the iron can be applied to creating smaller structure, less weight and the lower price that current conditions dictate.

Rehabilitated Transmission Line Defies Lightning

By F. S. DOUGLASS
Electrical Engineer
The Management & Engineering Corporation, Chicago

RECENT installation of Deïon flashover protectors on the Interstate Power Company's transmission line between Clinton and Dubuque, Iowa, has resulted in a line with no outages as a result of lightning to date even though severe lightning storms have been experienced. This substantiates tests made in the laboratory to check not only protective ability but also arc-quenching ability of the Deïon tubes.

After the line was built, in 1926, conditions changed so that a higher degree of reliability was considered necessary in this line, typical tower construction for the main portion of which is shown in Fig. 1. A study was made early in 1931 as to the best methods of making the line meet the new service requirements. Ground wires, two of which would be necessary for the type of construction, were considered, but it was found that they could not be easily installed on existing towers and that in addition the tower strength was not adequate for such additional loading. Further, the clearances from conductors to towers were such that no additional insulation could be effectively utilized. Moreover, the country through which the line runs is of a nature such that footing resistances were high and difficult to reduce. Even if the resistances could have been reduced and ground wires installed the insulation level would have been such that from experience on other lines a probability of eight to ten outages per year could have been expected. To decrease this number of outages would have meant a complete rebuilding of the line for clearances to accommodate more insulation and ground wires and would have meant added cost to reduce the tower-footing resistance.

Deïon flashover protectors had just been introduced to the line designer, but service experience was limited. It was felt that if such tubes could be designed to protect the insulator string from flashover and promptly to interrupt the power follow current, and one such tube installed at each string, the line would be practically lightning-proof, a result which was manifestly impossible with the use of either overhead ground wires or additional insulation, or both. Even with the limited field experience available when the tubes were considered, the favorable laboratory tests made for conditions simulating the actual application indicated that the selection of Deïon protectors was sound not only on a basis of better expected line operation but also from an economic point of view.

In order that the tube as described in Fig. 2 and mounted as in Fig. 1 would not be continually subjected to the normal line to ground potential a 4-in. normal and minimum or 5-in. maximum external gap was provided between the upper electrode and the line clamp. An arcing horn was provided on the upper electrode to maintain a constant external gap during insulator swing. Provision for venting the tube during discharge is had at the lower end.

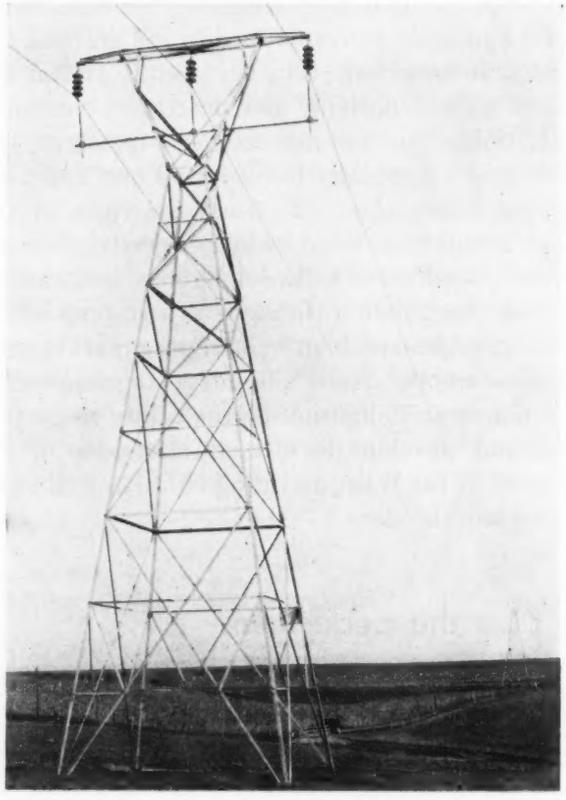


Fig. 1—Protection by tubes and no overhead ground wires

In a total length of 54 miles, 47 miles is on single-circuit steel towers with flat configuration with wires spaced 9 ft. 6 in. and 7 miles on double-circuit towers with vertical configuration. The line has no ground wires and is insulated with four 5¾-in. spaced 10-in. diameter units at suspension points and five such units at dead-end points.

Other types of tubes, differing from the one shown only in the shape of the arcing horn and the manner of attachment to the tower, were used on the double-circuit towers.

Tests show efficacy against impulse

A comprehensive series of tests was made prior to installation to check the general design data of the protector for the specific application to this particular transmission line. The units were to be applied to a 66-kv. line fed from a solidly grounded neutral source of power. The line-to-ground fault currents, in single-, two- and three-phase faults, ranged from 600 to 1,200 amp. symmetrical. The conductor was attached by a suspension clamp with arcing horns. These horns were removed when the tubes were installed to raise the flashover of the string.

For the purpose of making impulse tests a protector unit was supported on a grounded 2-in. pipe 6 ft. above

the floor. Above this was hung an insulator string and line clamp identical with those on the line. A length of ½-in. pipe in the clamp simulated the line conductor and a grounded section of angle iron above the insulator string simulated the tower. The maximum external air gap, 5 in., was used in order to check the worst condition.

Surge voltages of approximately 1½—40 microsecond wave shape were applied to the line conductor. The minimum surge was just below the flashover of the insulator assembly and the maximum surge was about 1,500 kv. Within these limits some fifty surges were applied to the assembly. In no case did the insulator string flash over or show distress. Points on the time-lag curve of the protector unit with 5-in. external gap are shown on curve B of Fig. 3. In order to determine the margin between the protector and the insulator assembly three check points on the latter are shown. Curve A of Fig. 3 is a standard time-lag curve for a four-unit insulator assembly and curve C is a calculated time-lag curve for the protector unit with a normal 4-in. external gap. It is evident from the time-lag curves that the margin of protection is greatest at the short time lags. In service on the transmission line it is probable that the surge voltages causing a discharge will be in this region.

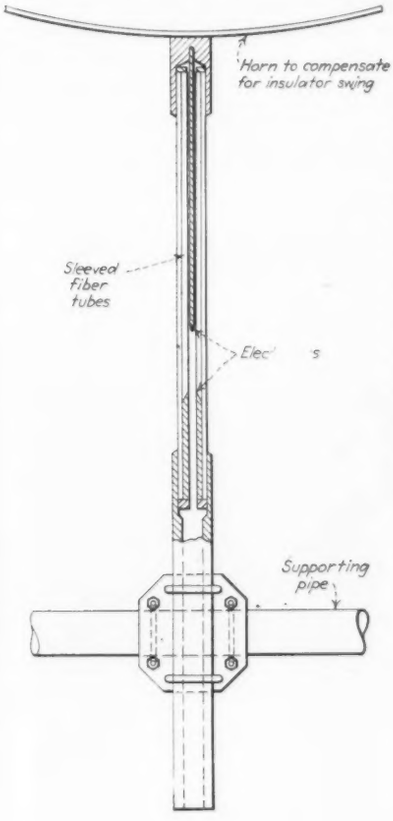


Fig. 2 — Breakdown through and not over tube

The unit consists essentially of an inner and an outer fiber tube with metal electrodes on each end, these electrodes extending into the bore of the inner tube so as to insure break-down through the tube rather than outside. A length of 2-in. pipe was clamped across the tower in a horizontal position beneath the insulator strings and the tubes were clamped to the supporting pipe as shown in Fig. 1.

One on each phase at every tower

In this test set-up, which was practically identical with the field installation, adequate protection against both low and high surge voltages was secured, the best protection being secured on the high surges. Considering the small difference in flashover between the protector unit and the insulator string it is evident that surge flashover protection will be obtained on that phase and tower where the protector is mounted, but that at an adjacent tower not so equipped the surge voltage could rise to a value above insulator flashover before the nearest protector could operate to check the rise. This dictated a protector on each phase per tower.

To determine the 60-cycle wet and dry flashover potential of the assembly the external gap was reduced from the maximum 5 in. to the normal and minimum 4 in. Under dry conditions the assembly with 4 in. external gap discharged through the tube at 160 kv. r.m.s. Under standard wet conditions the assembly flashed through the tube at 82 kv. r.m.s., or somewhat more than twice the normal line to ground voltage.

Under radio interference tests the line clamp and insulator string alone gave barely detectable radio interference at 48 kv. r.m.s. to ground. With the protector in position under the line clamp the assembly gave barely detectable radio interference at 53 kv. r.m.s. to ground. There was no appreciable difference after the bore of the tube was exposed to a saturated atmosphere for 60 hours. These results were obtained without the use of brass end nuts on the line clamps. Such end nuts were used on the field installation and would have the effect of increasing the potentials at which radio interference became detectable. It was evident that the protector tube itself would not be a source of radio interference, and that the complete assembly would have an interference only at voltages considerably above the normal line-to-ground voltage.

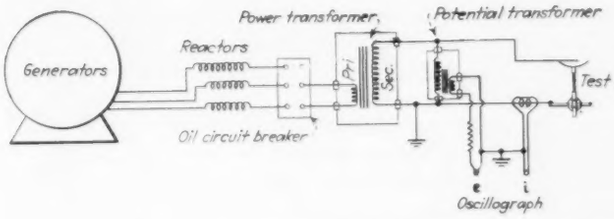


Fig. 4— Test circuit for oscillographic studies

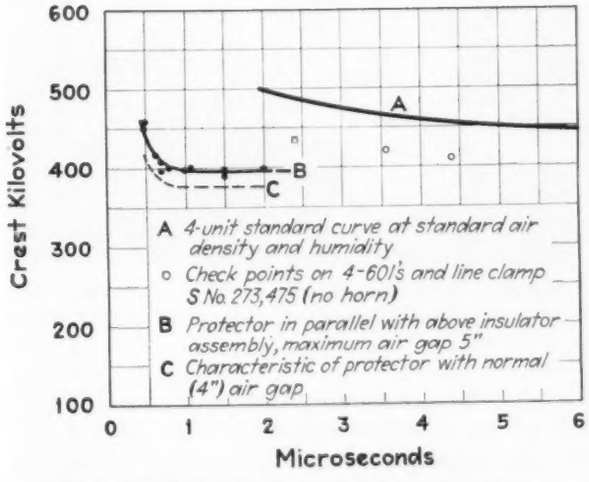


Fig. 3—Most protection at short time-lags

Power interruption tests were made by means of the circuit shown in Fig. 4. The internal gap and part of the external gap of the protector were shorted out by means of a fine copper wire. Power was applied by closing the primary breaker and an arc was always established by means of the fine wire. Had a surge generator been used to initiate the arc by means of a spark, as would occur in service, the arc would not always be established.

Power current was limited by the generator and trans-

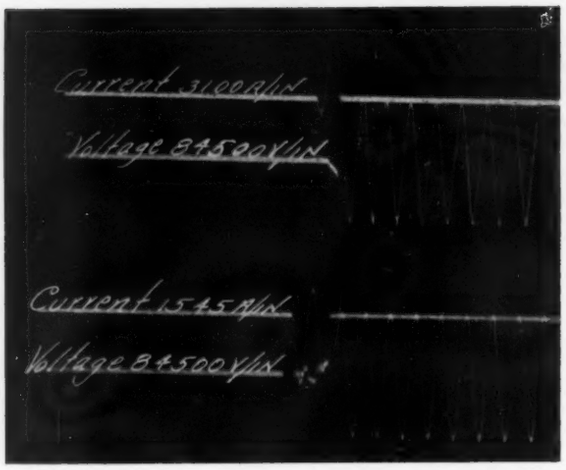


Fig. 5—Power arc interruption in one or two cycles

Record of the ninth operation on a unit with the plant set to deliver 1,200 amp. and record of the fourth operation on a unit with the plant set to deliver 600 amp. at 38,000 volts applied.

former reactance and by reactors placed in the primary circuit. The only load on the secondary was the potential transformer for the oscillograph. With this set-up a large number of tests were made on various protector units, with the plant set to deliver from 600 to 1,200 amp. at an applied potential of 38,000 volts to ground. In no case did the tube fail to interrupt the power current.

Both of the oscillograms in Fig. 5 show the applied voltage before the short air gap broke down, the time required to fuse the copper wire, the unsymmetrical current cycle and the recovery voltage at the peak of the voltage cycle and the current zero.

The installation of the protector tubes on the transmission line has been completed, a tube being mounted for the protection of each insulator string on the line. Some of the tubes have been in service for nearly two years and all of them have been in service since the latter part of the 1932 lightning season. Since their installation their performance has been such as was indicated by their behavior under the tests described above. They have been operating under various weather conditions, including one severe sleet storm, and no case of tube failure has been noted. Several severe lightning storms have occurred along the line since the installation was completed. These storms were of such severity that formerly lightning flashovers would have resulted, but no flashovers have occurred since the tubes were installed.

From the results of the tests of the Deion tubes and from the operating experiences so far obtained it is felt that the transmission line to which they have been applied will be practically free from outage due to lightning flashover.

▼ ▼ ▼

Molasses Heating for Feed Mills

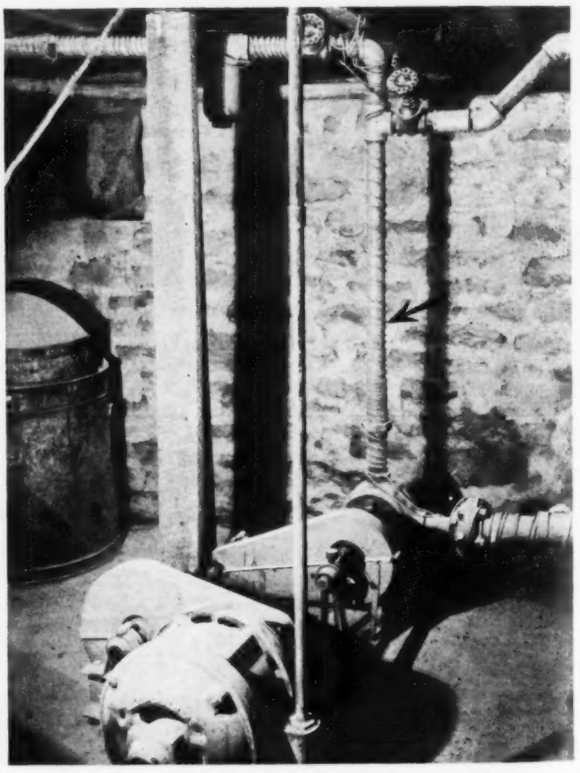
By D. E. BLANDY

Rural Service Manager
New York Power & Light Corporation

The illustration shows how lead covered soil heating cable was utilized to heat molasses in a small feed mill at Cobleskill, N. Y. The molasses is delivered by the railroad to a half-buried tank, located outside the feed mill. Up until the installation of electric heat, the molasses during prolonged cold spells would form in small globules from the spray nozzle, refusing to mix uniformly throughout the feed as it came from the grinders to the bagging machine.

On a maximum day, it was found that fifteen 200-pound batches of feed were handled and that it took ten minutes for each batch to go through the mill. The desired temperature rise was approximately 30° Fahrenheit. The specific heat of the molasses was 0.5 and the specific gravity 1.5. From these figures, it was determined that two kilowatts of electric heat would be required. The heat was obtained by wrapping 200 feet of General Electric Company soil-heating cable in non-inductive loops around the four-inch pipe leading from the molasses pump to the mixture. It would have been more desirable to install all the cable on the supply side of the pump, but this was impossible, due to the small amount of pipe exposed and the fact that the owner desired to make a minimum of cash outlay.

The wire has a resistance of ½ ohm per foot and, being divided into two 100-foot circuits across 240 volts, gave a total load of 2,300 watts. This wattage (higher than that calculated) was used, as the cable was to be uncovered, it being feared that should heat insulation be applied, a higher cable sheath temperature than that recommended by the manufacturer might result in breakdown of the insulation between the lead sheath and the nichrome resistance wire. The owner, William Colyer, reports complete satisfaction from his $20 installation.



Molasses heated by use of electric heat in the form of non-inductive resistance wire around the pipes

Industry 11 per Cent Over 1932

Confirming the reports of mounting employment and expanding output, data on electrical energy consumption received by the ELECTRICAL WORLD indicate a pronounced rise in the general level of industrial activity during May.

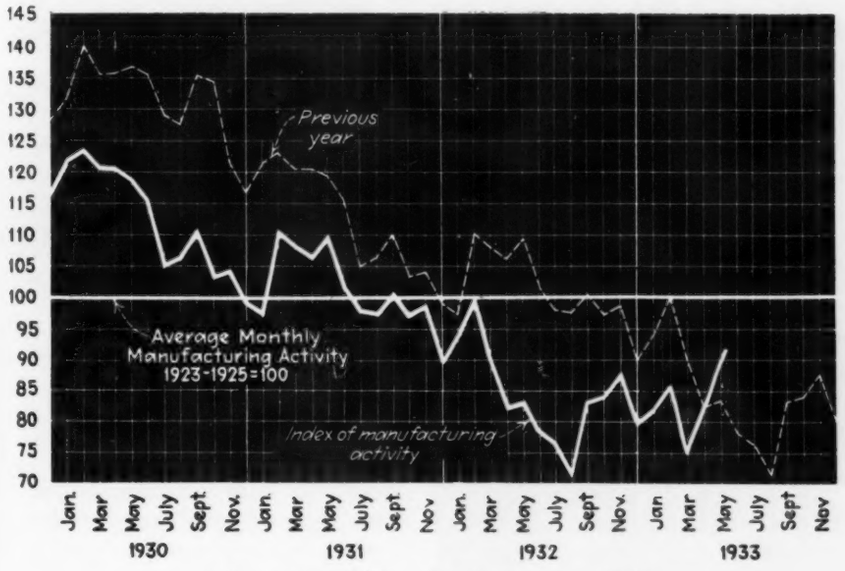
The weighted average index number for the United States rose to 91.3, compared with 84.4, the revised figure for April, and with 82.0 for May, 1932. Thus, the last month surpassed the preceding one, after allowing for a difference in the number of working days, by somewhat more than 8 per cent, following a previous rise of 12 per cent from the sag in March, and also increased the lead over 1932 to 11 per cent. It will be recalled that in April, for the first time since the middle of 1929, the index stood slightly higher than in a corresponding month of the preceding year. That favorable showing was not only repeated in May, but was materially improved.

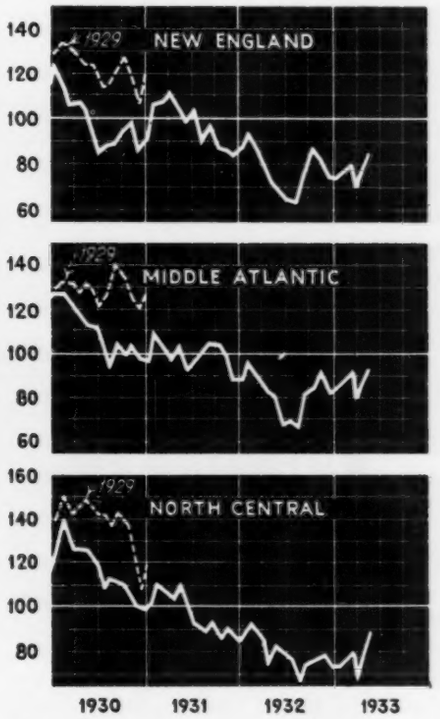
Again, the present index number is higher than any other since February, 1932, when the movement was still heavily downward toward the minimum to be recorded half a year later. The recovery from that minimum now amounts to 24 per cent.

With two exceptions every industrial group in the list rose above the April level, and in the two groups excepted, forest products and shipbuilding, the decline was nominal. Barring the one last named, also, every group registered an even larger gain compared with March.

Significantly, also, the advance was not confined to the "consumer goods" industries. Iron and steel moved up 8 per cent above April, notwithstanding an upward revision of the figure previously announced for that month, to incorporate late returns. Metal-working rose 12 per cent. The greatest gain, however, was in the stone, clay and glass group.

Regionally, further progress is indicated everywhere except in the West. In the North Central area a moderate increase in the automobile plants (figure subject to revision when delayed returns can be included) was accompanied by a much stronger gain in the associated rubber industry. New England textiles advanced, though still low, while the metal industries rose vigorously.


Previous year
Average Monthly Manufacturing Activity 1923-1925=100
Index of manufacturing activity
Jan. Mar May July Sept Nov Jan. Mar May July Sept Nov Jan. Mar May July Sept Nov Jan Mar May July Sept Nov
1930 1931 1932 1933



Index of monthly manufacturing activity

Base: Average month 1923-1925 = 100

(Corrected for number of working days, but not for seasonal variation)

These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.

	United States				New England				Middle Atlantic				North Central			
	May,	Apr.,	Mar.,	May,	May,	Apr.,	Mar.,	May,	May,	Apr.,	Mar.,	May,	May,	Apr.,	Mar.,	May,
Industrial Groups	1933	1933	1933	1932	1933	1933	1933	1932	1933	1933	1933	1932	1933	1933	1933	1932
All Industry	**91.3**	**84.4***	**75.3**	**82.0**	**85.2**	**73.8***	**70.2**	**71.0**	**96.0**	**86.3**	**80.8**	**78.5**	**88.2**	**79.8***	**67.8**	**82.7**
Automobiles (including parts and accessories)	58.9	54.8*	42.6	69.3	....	....	....	....	55.2	50.6*	37.1	66.2	59.1	55.5	41.4	69.0
Chemical products (including oil refining)	126.6	121.0*	115.6	129.9	134.0	143.0	142.5	149.8	131.0	124.6*	121.7	138.2	128.1	115.7	101.7	119.0
Food products	123.2	119.7*	101.5	116.3	....	....	....	....	120.2	123.0*	107.0	92.3	121.4	115.6*	96.2	119.7
Iron and steel	67.3	62.3*	50.5	61.8	103.7	81.2	82.2	78.8	57.0	46.8*	40.8	52.1	72.8	71.8*	54.0*	66.2
Metal working	61.9	55.3	50.5	55.8	82.0	68.7*	64.2	71.5	55.7	52.3*	47.2	54.5	64.8	55.7*	50.1	54.7
Metals group	**63.8**	**58.0***	**50.5**	**58.1**	**88.2**	**72.3***	**69.3**	**73.6**	**56.3**	**50.0***	**44.5**	**53.4**	**68.0**	**61.8***	**51.5***	**59.2**
Leather products	93.5	82.5*	81.4	74.7	76.0	73.3*	69.7	60.8	123.3	104.2*	117.9	97.8	81.5	67.9	66.8	59.7
Forest products	87.2	89.5*	84.7	77.8	39.9	38.9*	33.2	41.8	55.8	58.7*	56.3	62.7	83.2	71.4*	58.4	80.8
Paper and pulp	112.0	102.3*	95.2	102.7	111.8	93.5*	90.8	109.4	89.0	74.0	70.0	67.5	104.4	103.0*	97.8*	99.2
Rubber products	116.7	82.0*	68.0	95.5	112.9	69.9*	65.2	84.2	....	....	....	....	116.5	80.2	67.7	96.9
Shipbuilding	71.3	73.0	71.5	86.8	....	....	....	....	....	....	....	....	....	....	....	....
Stone, clay and glass	91.8	74.5*	68.8	97.9	....	....	....	....	68.8	49.7*	48.6	85.7	110.0	86.7	74.7	118.3
Textiles	96.4	86.0	79.0	62.8	70.2	61.6*	56.5	48.2	131.5	114.4*	108.3	80.2	118.4	114.8*	103.6	91.5

*Revision.

South and West Also Gain

Industrial activity in the South, measured by electrical energy consumption in individual manufacturing plants, as reported to ELECTRICAL WORLD, was 4.5 per cent greater in May than in April and 15.6 per cent greater than in May, 1932. In the West, the two months of the present year were equal, after taking account of a small upward revision in the April figure, but there remains a gain of 9 per cent over last year in contrast with 7 per cent for April.

One of the prominent factors contributing to the rise in the South was a gain of 8 per cent in textiles, bringing activity in that industry nearly 50 per cent above the status a year ago. Comparison of the index numbers with those for New England brings out the shift southward that has taken place in recent years. While the index for Southern mills is well above the 100 mark, based on the average for 1923-1925, that for the East is around 70.

Another factor is the improvement in the metal-working shops, where a gradual pick-up is in evidence, with present activity ahead of that of 1932. Iron and steel fell off somewhat, but the index is 45 per cent higher than a year ago and the trend is definitely upward.

Western food, metal, stone and forest products industries are all more active than they were a year ago, and all of them but the last gained over April, as did also the pulp and paper industry. Chemicals and rubber, in contrast, remain under their 1932 rate. In metals, the rise has been moderate but steady, at a level well above last year's.

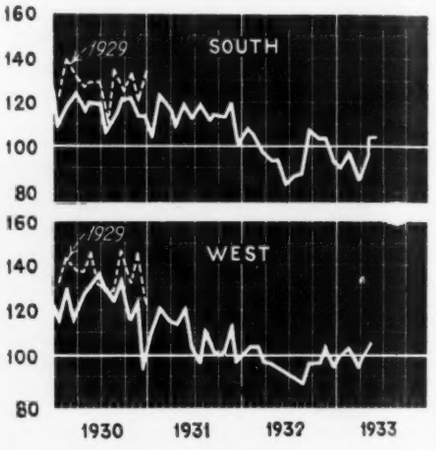
Index of monthly manufacturing activity, South and West

Base: Average month 1923-1925 = 100

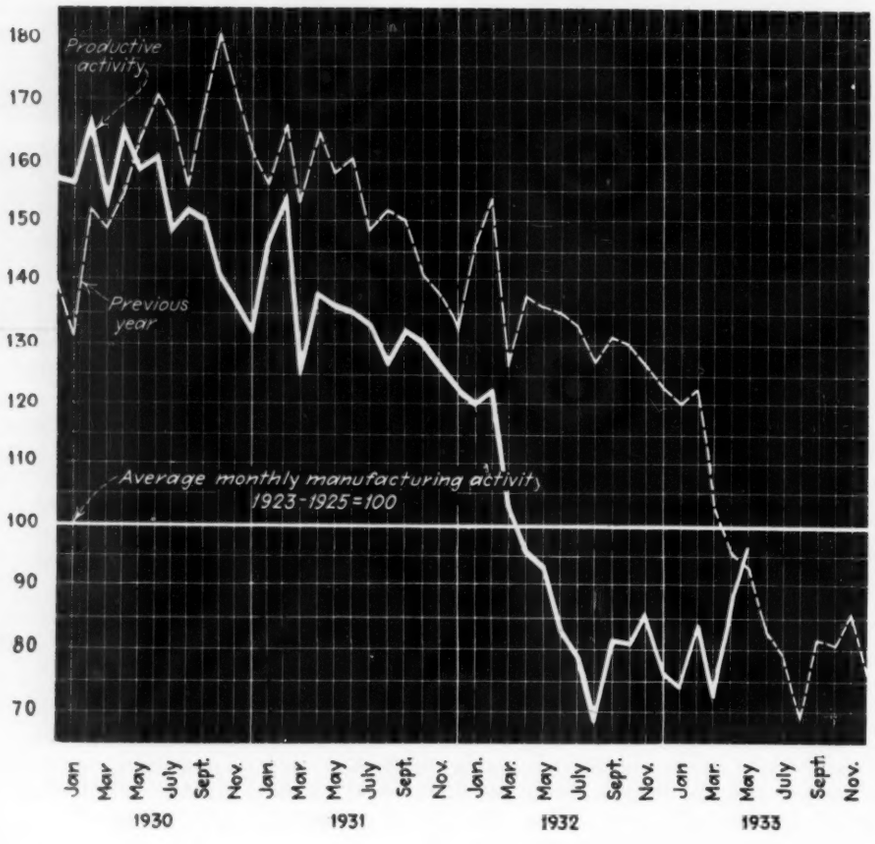
(Corrected for number of working days, but not for seasonal variation)

Industrial Groups	South					West				
	May, 1933	Apr., 1933	Mar., 1933	Feb., 1933	May, 1932	May, 1933	Apr., 1933	Mar., 1933	Feb., 1933	May, 1932
All Industry	**104.3**	**99.8***	**85.9**	**99.3**	**90.3**	**103.2**	**103.2***	**95.8**	**102.0**	**94.3**
Chemicals	138.0	132.0*	124.7	135.2	130.2	76.2	82.4*	70.3*	79.8	90.1
Food products	148.0	148.2	127.2	131.5	153.4	125.3	121.0*	108.3	118.2	115.3
Iron and steel	93.8	98.5	60.3	82.7	64.8	....	....	....	....	....
Metal working	71.6	59.9*	63.6	85.7	64.6	....	....	....	....	....
Metals group	84.1	81.5*	61.8	84.0	64.7	49.2	47.5*	45.4	44.8	63.2
Forest products	42.5	37.2	28.4	37.6	37.6	136.6	142.0*	136.7	144.8	117.0
Paper and pulp	148.0	141.4*	133.5	151.5*	126.0	139.2	130.0	111.0	127.0	143.0
Rubber products	126.8	101.7	73.0	109.3	83.8	73.2	56.2	27.9	46.8	100.7
Shipbuilding	....	....	....	....	....	98.1	105.4	96.3	122.3	102.5
Stone, clay and glass	139.5	145.3*	109.0	101.8*	124.0	104.2	91.0*	109.3	83.7	79.1
Textiles	114.9	105.8*	94.7	119.3	77.5	....	....	....	....	....

*Revision.



Electrical Industry Breaks Through



For the first time since the early part of 1930 energy consumption in electrical manufacturing plants indicates a higher rate of operations than in the same month of the preceding year. Rising 8 per cent over April, returns for May reveal an excess of 4 per cent this year, compared with 1932.

Monthly Index of Electrical Manufacturing Activity

Adjusted to 26 working days

Base: Average Month, 1923-1925

Month	1930	1931	1932	1933
January	156.2	146.6	120.0	74.0
February	165.2	154.3	122.2	83.3
March	153.0	126.1	102.9	75.0
April	164.9	138.1	95.6	89.4
May	158.0	136.7	92.8	96.8
June	160.2	135.2	83.1	....
July	148.5	133.4	79.2	....
August	152.2	126.9	67.6	....
September	150.0	132.6	81.4	....
October	140.6	130.4	80.9	....
November	137.5	126.9	85.6	....
December	132.4	123.5	76.0	....

Unlike other recent months, when the gains were predominantly in the smaller establishments, May brought a strong forward movement for the larger ones as well. Moreover, the rise was not localized; while more or less spotty in New England it was fairly general in the Middle Atlantic and North Central States.

Analysis of Trend in Fixed Capital Replacements*

By W. J. LYMAN

Electrical Planning Engineer, Duquesne Light Company

THE problem of replacing fixed capital, due both to deterioration and obsolescence, is a vital factor in the planning of electric light and power companies where plant investment is so large compared with the gross annual revenues. Regardless of the policy on future financing, the existing plant can be kept intact only by diverting a portion of current revenues to compensate for necessary retirement of deteriorated and unsafe equipment and apparatus rendered obsolete by load growth, modern improvements or local reductions in demand for power.

Although revenue deductions for retirements have up to the present time been entirely adequate, they will increase considerably in the future, changing from a relatively unimportant matter during a period of rapid growth and substantial earnings to a serious and burdensome problem of management.

The magnitude of annual replacements will depend naturally on the effective useful life of all equipment involved. Another factor which has a great effect on the actual annual percentage replacement is the rate of growth of the business. This is true for the reason that equipment installed during any given year will not be replaced until its useful life has elapsed, say in twenty years. If the business has been growing consistently it will be found that when the twenty years has elapsed the fixed capital and the annual revenue will have reached possibly several times the original value. Due to this fact, the replacement of equipment installed twenty years prior can be financed with a very small percentage of the current revenues.

To illustrate with a concrete, and not unusual, example, assume the fixed capital has increased four times over the twenty-year period. Then a retirement equal to 5 per cent of the original capital will be only 1¼ per cent of the present fixed capital, and with a capital ratio of six to one, 5 per cent of the original equipment now being replaced can be handled with 7½ per cent (or 6 x 1¼ per cent) of current revenues. In this manner the retirement program is always several years behind the growth and the percentage retirement figure remains small. It has been shown by an authority on this subject† that an average useful life of twenty years, combined with an annual growth of 10 per cent, will result not in a 5 per cent replacement, but only 1.8 per cent per year.

Naturally, if the business should cease to grow and the fixed capital and revenues should remain constant the replacements would ultimately reach the figure of 5 per cent on the current fixed capital. With a capital ratio of six to one this would mean that 30 per cent of the gross would be needed for retirements.

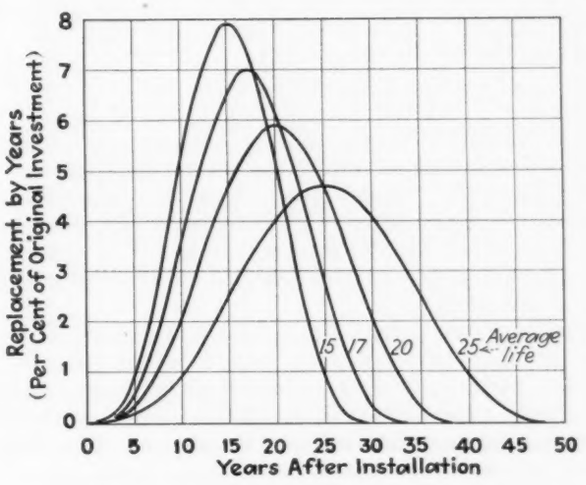


Fig. 1—Standard symmetrical capital replacement curves

Development of long-range replacement

The following will be an attempt to develop, through a technical analysis of the problem over the entire history of one company, a theoretical long-range replacement curve and to so adjust the basic assumptions as to equipment life to give results for the past decade which correspond accurately with the actual experience. This analysis can then be extended into the future with reasonable assurance that the forecast furnishes a sound background based on principles and practices which have proved themselves during the past.

Reliable information relative to actual useful life is very difficult to obtain. A cursory investigation was made of power plant equipment which had been retired during the past. These figures ranged from three to 26 years, with an average of less than ten years. The age of the generating units now in service ranges from two to seventeen years. An investigation of the wood-pole lines which have been rebuilt during the last several years showed an average life of about fifteen years.

An accurate knowledge of the life of equipment during the past is not essential since depreciation rates in the future will certainly be quite different. The high mortality rates during the past have been due in a large measure to obsolescence brought about by improvements in equipment and rapid growth in the size of the system. In the future equipment changes due to rapid growth will probably be less frequent. Although further improvements in efficiency of new apparatus will not be as marked as in the past, the problem of obsolescence will still be very important, even though less in magnitude

**Second and concluding installment of James H. McGraw first-prize paper on "Fundamental Considerations in Preparing Master System Plan," started in June 17 issue.*

†Dr. Philip Cabot, professor of public utilities, Harvard University.

and of a different nature. Progress is inevitable and changes must be made in any business in order to keep it healthy. This tendency has been recognized in the following analysis through the assumption of an increasing useful life.

In general, equipment is not replaced on a straight-line depreciation rate. On the contrary, replacements during the first few years will be light, increasing in percentage to a maximum at approximately the average life, and decreasing thereafter until the last piece has been replaced. Experience curves showing this for various types of equipment are available. This case, however, deals with an aggregate of many different types of equipment from the power station to the customer's meter. Standard symmetrical replacement curves were selected as shown on Fig. 1 for several different values of average life. These curves show the percentage of the original investment which is replaced each year during the total life and they can be applied to the gross construction in any year to forecast the replacements by years thereafter.

The next step in carrying out this replacement analysis is to obtain a curve for fixed capital back to the origin of the company. It may be necessary to estimate arbitrarily the early portion of this record, but the accuracy of this assumption has little effect on the results during recent years.

If the true average life of equipment installed at all stages of the development were known the curves on Fig. 1 could be applied to the net increases in the fixed capital curve of Fig. 2 to give the replacements thereafter. Consequently, reasonable values of average life were assumed and the corresponding replacement curve applied to the capital improvements for the first five years. Five-year increments were used to simplify calculation. This distributed the total construction for these five years over a period of about 30 years, ultimately replacing them entirely. The net construction for the next five years was then taken, together with the replacements of equipment installed during the first five-year period. This gross construction was then distributed in accordance with the replacement curve.

In this way the net construction each year was added to the replacements, giving the total new equipment installed, which was distributed according to the replacement curve. The results of this process are shown by the theoretical replacement curve (4) in Fig. 2.

A significant step in process

The next step in the process is very significant. Various values of average life were applied during the different parts of the program by the cut-and-try method until the theoretical replacements for the last nine years corresponded accurately with the actual total replacements during the same period. In this way the method and assumptions are checked up and made to correspond with actual experience. Projection of this curve into the future can then be done with some assurance that the result will be reasonable.

These figures will, of course, give a smooth curve of normal replacements, although the actual year-by-year replacements will depend largely on the construction program and will be apt to vary considerably from the normal trend. However, the average over a period of years should correspond. It is important to note that the solution in this case was obtained by assuming an average life of fifteen years for all equipment installed prior to

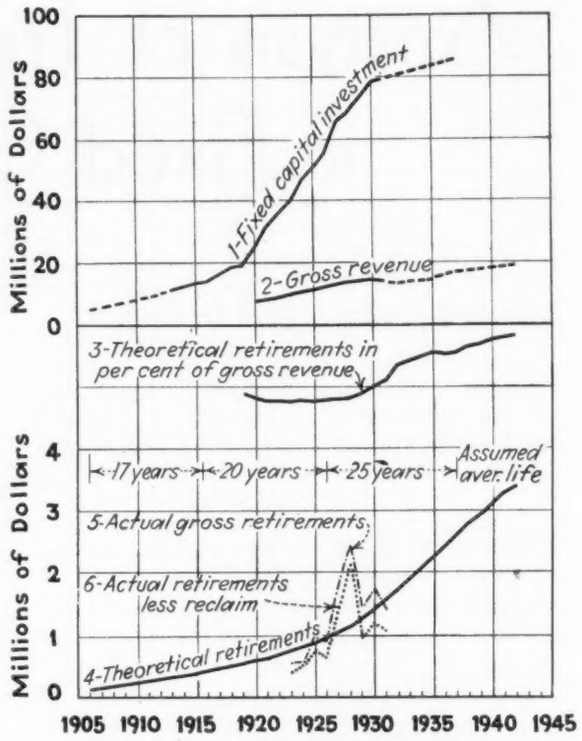


Fig. 2—Analysis of trend in fixed capital replacements

Based on actual experience of one company

1906, seventeen years for equipment installed from 1906 to 1915, twenty years from 1916 to 1926 and 25 years thereafter. A 25-year average life of all equipment is believed to be conservative for the future. Experience in other industries seems to indicate that this useful life is almost too much to expect.

On Fig. 2 is shown a curve (5) of actual retirements during the period 1923 to 1931. These retirements include a considerable amount of equipment which is retired from one location and returned to the storeroom to be used again. For example, a distribution transformer may be retired after two or three years in service due to load growth and be reinstalled at another location shortly. The same transformer might conceivably be retired four or five times during its useful life. This type of retirement does not represent the end of useful life and should be eliminated from the total.

Curve 6 on Fig. 2 shows the annual retirements reduced by the amount of reclaim to the storeroom. This eliminates the above-mentioned item and leaves equipment actually scrapped. However, reclaim to the storeroom is usually made at original cost and some of the equipment has depreciated considerably before being retired; consequently, a truly representative curve of useful life is probably between the two curves mentioned. It can be seen that the solution has been so arranged that the theoretical replacements for the nine years will average less than the actual gross retirements, but somewhat higher than the actual net retirements after subtracting reclaim.

Another important check between actual and theoretical retirements was made by studying a group of accounts which contained only the equipment in service before 1919. No additions have been made to this account and all retirements from the original equipment

have been deducted. The figures from the theoretical solution were found to check almost exactly with the actual amounts remaining in these accounts.

The amounts shown on curve 4, Fig. 2, represent the equipment removed from service. However, the net cost of this retirement program varies only slightly from this figure, since other factors such as "labor to remove" and "sale of scrap" tend to offset each other. The records bearing on this subject were carefully analyzed for the nine-year period. The return from the sale of scrap material was almost sufficient to pay for the cost of removal. Other items, such as material from storeroom, labor to scrap and other expenses accounted for the relatively small net cost of removal (5 per cent of total retirements). In view of these figures it was beliveed that the data on curve 4 can be used as a forecast of the amount of money normally required for retirement reserve.

It would seem that the above solution to the problem is reasonably accurate and that the forecast for the next decade can be used as a fair index. Curve 3 on Fig. 2 shows the per cent of the gross revenue necessary to finance the replacements from curve 4. The percentage generally used has been entirely adequate during the last ten years to cover the actual retirements. The significant fact, however, is the probable increase in this percentage in the next decade, making the replacement requirements a much more important item on the profit and loss sheet. It is obvious that failure to recognize this trend would gradually weaken the financial structure, seriously undermine ability to utilize new developments and meet growing competition, and result in ultimate disaster.

The results of this study are believed to be fairly representative of the entire industry and illustrate clearly the probable trend in fixed capital retirements during the next ten years. It is believed that this possibility should be considered along with other important elements in establishing any policy affecting the financial status of the company.

▼ ▼ ▼

Contrasts in Sodium-Vapor Light

By M. LUCKIESH

Director Lighting Research Laboratory, General Electric Company, Cleveland

CONTRAST is the most generally effective factor in seeing. This fact has been established by studies of the relationships between the fundamental factors, such as size of the object or its critical detail, brightness or intensity of illumination and time available for seeing. For example, by varying the intensity of illumination from ordinary low values of artificial light to those of full daylight, the minimum size which is just visible varies through a range of three to one. However, by varying the brightness contrasts from a very low value to that represented by black on white, the minimum size which is just visible varies through a range of thirty to one.

Although the sodium lamp is still in the experimental stage, its effects upon visibility are of interest. Recently its superiority in revealing fine detail has been shown.* The investigation of contrast is a more difficult matter.

Sodium-vapor light, being monochromatic, or nearly so, eliminates the advantages and possibilities of color contrast. And, of course, it has the disadvantage of distorting colors where such distortion is undesirable. However, it may find practical applications in low-intensity lighting and in special cases of inspection where color values are not important.

In order to study its influence upon contrast, the brightnesses or reflection factors of 101 specimens of colored paper were measured under equal intensities of illumination from a sodium-vapor lamp and a tungsten-filament lamp, respectively. The colored papers represented hues throughout the spectrum and including the purples. Several tints and shades of each hue were included. Besides these, there was a variety of common shades, such as buffs and browns.

The data are condensed in the accompanying table for convenient consideration.

Specimens	Number of Specimens	Average Reflection Factor Tungsten	Sodium
Brighter under sodium light	42	45	53
Brighter under tungsten light	42	29	22
Approximately of same brightness under both lights	17	27	27
All	101	35	35

From these data it is seen that (1) the grand average reflection factor of all the specimens is practically the same under both illuminants; (2) under sodium light the brightnesses are generally distributed more widely each side of the average than under tungsten light; (3) under sodium light the proportion of specimens of very high and very low reflection factors is greater than under tungsten light.

The basis for selecting 101 specimens was that, taken two at a time, 5,000 pairs could be studied. After determining the reflection factors of each of the 101 specimens under the two illuminants, respectively, the determination of the contrasts† of the 5,000 pairs is merely a tedious mathematical procedure. Actually, only 595 pairs have so far been studied, but these are sufficient to show again the general superiority of sodium light over tungsen light in accentuating contrast. A condensed summary is as follows:

267 pairs exhibited greater brightness contrast under sodium light than under tungsten light. The average brightness contrast of these was 50 per cent under tungsten light and 66 per cent under sodium light.

152 pairs exhibited lesser brightness contrasts under sodium light than under tungsten light. The average brightness contrast of these was 43 per cent under tungsten light and 29 per cent under sodium light.

176 pairs exhibited brightness contrasts varying within ± 5 per cent, so that they were not included in the fore-

*"*Visual Acuity in Sodium-Vapor Light*," M. Luckiesh and Frank K. Moss, Journal Franklin Institute, 215, 1933, 401.*

†*We define contrast as the ratio of difference between the two brightnesses divided by the higher brightness. A perfect black on a perfect white is a contrast of 100 per cent.*

going in which the differences in brightness contrast were greater than 5 per cent under both of the illuminants. Such low contrasts cannot play an important part in seeing. They are so low that quick and certain seeing must rely upon other factors.

From a purely numerical viewpoint the sodium light enhances contrast in more cases than tungsten light does. This is a fact on the side of superiority for sodium light. However, further analysis modifies this advantage somewhat. It will be noted that the 152 pairs whose contrasts were greater under tungsten light had an average contrast lower than the average of the *267* pairs whose contrasts were greater under sodium light. In other words, the tungsten light helped more where visual aid is more generally needed; that is, for generally lower contrasts which are in a lower range of visibility than higher ones.

Doubtless a complete analysis of the 5,000 pairs of contrast available would alter the actual values, but there is no reason for believing that it would alter the general conclusion. Apparently, we have shown by actual statistics that sodium light has some advantage in accentuating contrasts in general, although, of course, in specific cases it completely obliterates brightness contrast as it always obliterates color contrast. These cases may be very crucial ones. A purely monochromatic light offers advantages in many cases, but it is well to bear in mind the disadvantages, particularly where the colors and reflection factors of objects are not under control.

▼

Minimum Charge Clause Should Be Specific

By LESLIE CHILDS

Indianapolis, Ind.

Where a power company contracts to furnish a consumer his requirements of electricity for a given period provision is made for a minimum charge, whether any energy is used or not. However, in drawing a power contract with a minimum charge provision a power company may well be cautious so as to prevent any confusion in the use of terms.

If it is the intention to bind the consumer for the minimum charge throughout the contract period this should clearly appear. Otherwise, if the consumer goes out of business, or shuts down for a long period, serious dispute may arise as to whether the minimum payment clause survives the consumer's lack of requirement for any electricity at all. The possible danger to a power company in overlooking this is illustrated in a recent case that arose under the following facts:

A power company contracted to furnish an industrial concern its requirements of electricity. The contract, in so far as material here, provided:

> The company agrees to connect its three-phase, 220-volt service with premises of consumer . . . and to furnish electric energy for 105-hp. motor, . . . and company agrees to furnish to consumer and consumer agrees to purchase from company all electric service and energy for power to be required or used by consumer on said premises during the period of three years . . .
>
> Minimum monthly charge under each meter whether energy is used or not, $1 for each horsepower, or fraction thereof, of connected load. . . .
>
> The consumer agrees to notify the company before making any changes in the connected load at its premises hereinabove described.
>
> If the consumer violates this contract there shall immediately become due and payable as damages, not as a penalty, the minimum payment named herein for the unexpired term of the contract, or extension thereof; provided, however, that if the consumer discontinues the service temporarily without intending to violate this contract, then the monthly minimum charge shall be paid monthly as herein provided.

Customer discontinued use abruptly

Pursuant to this contract, the company spent about $4,000 in constructing a new pole and wire line to connect with the consumer's plant. The latter started using the service on June 1, sold its plant on June 27, and assigned this contract to the purchaser. The latter operated the plant during July and August, then disconnected the motors and wrote the company: "We do not know whether or not the plant will ever again be operated."

Thereafter the company brought action against both the consumer and its assignee for $290, that being the minimum charge for energy used during July and August which had not been paid, and *also* for $105 for each month of the remainder of the term of the contract, under the minimum monthly charge provision thereof. This, then, squarely raised the question of whether the minimum monthly charge provision of the contract survived the consumer's entire lack of requirement for electricity. In reasoning thereon the court, among other things, said:

> The limit of the obligation of the electric company is "to furnish electric energy for 105-hp. motor." The limit of the obligation of the consumer is "to purchase from company all electric service and energy for power to be required or used by consumer on said premises." We do not see in this contract any prescribed minimum quantity of service or energy which the consumer is under any obligation to take or pay for, other than the amount thereof "required or used" at the plant.
>
> The evidence plainly shows that neither of these consumers has had any need or requirement for any service or energy between August 27, when the electric company was notified that the motors of the plant had been disconnected . . . up to the time of the commencement of this action. We do not overlook the words of the contract "minimum monthly charge under each meter whether energy is used or not, $1 for each horsepower, or fraction thereof, of connected load."
>
> This, we think, means only that, when the consumer maintains a connected load, or wholly disconnects the connected load and fails to notify the electric company of such disconnection, the consumer must pay for the load up to the time of notice of disconnection thereof whether "used or not." Neither do we overlook the further provisions of the contract relating to the rights of the electric company which might accrue to it, "if consumer violates this contract," but we are quite unable to see that the consumer can be held to have violated the contract by disconnecting the load, and notifying the electric company thereof, when the consumer has no requirement or use for the service or energy in the operation of the plant. . . .
>
> We conclude that the electric company is entitled to recover. . . in the sum of $290 for the 145-hp. load connected during the months of July and August, . . . and that the electric company is not entitled to any other award in this case. Willapa Electric Co. vs. S. L. Dennis Construction Co., Supreme Court of Washington (12 P., 2d. 609).

The electric company was unable to enforce the minimum monthly payment provision for the term of the contract. The court, in effect, held that the requirement clause of the contract controlled, and that when the consumer ceased to have any requirements the minimum monthly payment provision had no application.

Two justices dissented from the decision, but the decision is the law and is an example of the importance of drafting "requirement" contracts.

Commercialism and Competition—Today and Tomorrow

By GEORGE E. WHITWELL*

Philadelphia Electric Company, Philadelphia, Pa.

HERE is the power salesman. What are his problems? You may classify them in some other way, but I give them to you under three general headings:

First—The problem of meeting competition in the sale of new business.

Second—The problem of retaining business which we now have.

Third—The problem of stimulating the market so as to replace sections of that market which have been saturated by past sales efforts.

To get more business, to hold that which we have, to open up new fields and new uses so that we have an ever-expanding potential use for electricity—are not these the problems confronting the power salesman?

Since the largest single item of expense in the cost of central-station energy results from past investments at higher prices, it will be impossible to take care of the spread by immediate drastic rate reductions without setting up a tariff lower than the cost of production. Also, since the effect of reduced commodity prices can only be realized in our tariffs as existing equipment is replaced by new equipment at the lower price, it is always a number of years before the full effect of reduced investment costs can be reflected in our rate structure. These facts compare with the almost immediate drop in our competitors' prices. The severity of this condition will, of course, be modified by any increase in kilowatt-hour delivery due to improved business conditions, and it will be aided by any sound and permanent reasonable increase in commodity prices.

It would appear that, under these conditions, the loss of a relatively small amount of business is inevitable. Instead of worrying too much about this, let us rather use our energy in keeping it to a minimum by several methods:

First—By making use of the natural hesitancy and frequent inability of customers to make investments at a time when liquid capital is needed to help tide the business over a depression period. This, naturally, makes the customer lend a receptive ear to short amortization periods, as his capital is worth more to him as a means of insuring the continuance of the life of the business than it is fixed in machinery to produce power.

Second—By impressing upon the customer the need for using conservative fuel, material and labor charges over this short amortization period so as to insure the return of his capital over the selected interval of time.

Third—By developing all the possibilities inherent in the establishment of off-peak rates, both seasonal and daily. This method is effective in several ways:

(a) It offers the customer a reduction in cost and spreads a relatively low loss of revenue over a very large number of customers because everyone can take advantage of it who can afford to rearrange his operations.

(b) It has an appeal to the customer in that it offers him something which places the amount of his savings under his control.

(c) It gives the salesman an added talking point in selling new business.

(d) It introduces a personal incentive on the part of the customer to improve his operation from the central station viewpoint, so that the over-all effect of the continued pressure of this personal incentive should, over a period of years, result in a decided improvement in the shape of the industrial load curve.

(e) In so far as the central station is concerned, this method of price change has, in addition to the foregoing advantages, the further attraction that it does not interfere with the basic rate structure. If some of the effect of improvement in the industrial load curve becomes apparent before basic rate reductions are forced by the need to meet the market, there may be a sufficient reduction in over-all utility costs, due to this improved industrial load curve. to permit, without loss, a certain amount of basic rate reduction.

Develop new applications in industry

The third problem of the power salesman, namely, the development of new applications of electricity, naturally looks toward the general future development of the industrial business of the central station and offers considerable difficulty on account of the relatively limited sales expense possible due to the low unit cost of our product as contrasted with the great number of individual prospects in the market. It is possible that the answer to this problem is the co-operative sales campaign, which requires that each branch of the entire industry does that which it can do best and most economically, thus eliminating duplication of effort. The value of coordinated effort is based upon the following two facts:

First—That the sale of our product for power is de-

**Abstract of address presented at E.E.I. Convention, June 5, 1932, at Chicago.*

pendent upon the sale by some one else to the customer of utilization equipment, and

Second—That the central station should know the market and its needs better than any one else who is interested in that market.

With these two thoughts in mind the co-operative sales campaign naturally takes the following form:

(a) An advertising campaign in which the utility and interested manufacturers, contractors or distributors co-operate on an equal division of expense basis.

(b) This advertising campaign to be developed by the utility, with the approval of the co-operating agencies, in order to sell the idea of the particular application to the selected market. This advertising matter should not urge the sale of any particular make of equipment.

(c) Selection of the proper list of customers to be attacked in this campaign.

(d) The follow-up of the advertising by the utility's salesmen in the attempt to eliminate the immediate from the deferred prospects.

(e) Follow-up of the immediate prospect list by the salesmen of the co-operating agencies so that the utilization equipment is sold.

This plan answers the problem of man-power and coordinates the industry job in a way which, generally, has not been followed before. It permits the timing of the attack and facilitates a planned annual drive on each phase of the market until saturation is reached, when the entire co-operative organization can be directed in the same manner at another phase of the market. It eliminates the missionary work by the manufacturer and gives him a list of real prospects on which to concentrate his selling.

It is obvious that the only way in which volume can be maintained in the face of the saturation of the isolated plant field is by adopting some plan which will increase the number of kilowatt-hours per man in industry. In other words, new applications must be sold to existing customers in increasing volume. The method just proposed is applicable in any field of industry, whether it be air conditioning; industrial heating applications, large and small; lighting; commercial cooking, or whatever, for you, offers the quickest immediate results. It puts merchandising methods into power and light selling. It will meet a lot of the competition you are worrying about.

To increase domestic energy use

The appliance problem in the domestic market is the distribution of equipment and its continuing use by customers. It is just as simple as that. Most of us try to make it a great deal more difficult. Most of us are so set in our opinions that our way of accomplishing this objective is the only right way, that we overlook a tremendous number of bets inherent in the other fellow's way were we only sensible enough to adopt them. The question is not fundamentally, as I see it, whether a utility should merchandise or whether it should not; whether a city should have an electric league or whether it should have some other sort of association industry group; whether there should be a district representative plan or whether specialty salesmen should be employed. The fundamental problem is the maximum distribution of appliances on some basis, best suited for a particular locality or group of localities, on which the manufacturer, the jobber, the contractor-dealer, the department store, the hardware store, all other retail outlets, and the utility, each does that which it is best fitted to do. On such a basis each is permitted—granted reasonable business ability—to make a profit and each sees to it that he knows his market and has provided ample coverage so that his particular products constantly forge ahead. Here are a few things that, it seems to me, we can never afford to lose sight of in getting distribution and use of appliances:

The ultimate consumer is not yet sold with real desire for more than a fraction of the electrical appliances he could use to his own advantage and to his own greater comfort in creating for himself an easier, better, simpler life. While you have all heard it many times before, I repeat that the electrical industry has a big promotional job ahead of it—a job that must be co-ordinated nationally and locally.

The completely successful financing of sales of appliances is as yet an unsolved problem. Many methods have been tried; some have been good, some bad. Recently there have been some new developments, but, by and large, the electric utility has a great interest in obtaining the best solution in its territory to the problem of how to finance the distribution of electrical appliances.

There is much to be done in developing standards of construction and performance of appliances. The utility has had since the beginning of the electrical industry, and still has—perhaps in some respects to an even greater degree—the responsibility of protecting the consumer against inferior merchandise and encouraging quality construction by manufacturers.

All industries need better and higher-type, and perhaps better compensated, salesmen. The electric utility business is no exception. There is a training job to be done if the salesman is to be able to produce maximum personal business, do the best possible industry job, and keep appliances in use and create desire for additional equipment.

There must be new ways constantly created for getting customers' attention and creating interest. Yesterday's brilliant idea is moth-eaten today. There must be continually better advertising, more of it, and new sales appeals.

Finally—In keeping appliances in use, it seems to me that the future should see more attention paid to this phase of our domestic revenue problem. You know as well as I that selling the appliance does not necessarily automatically provide for the sale of domestic kilowatt-hours. You know it so well that I am almost ashamed to repeat it. I say it because very few of us, if any, have ever developed an adequate selling program for assuring continuing use of appliances. Today, perhaps, this job is more important than ever before.

Selling the commercial customer

I think it is true that, in approaching the problem of selling the smaller commercial customer, one encounters the possibility of the sale and use of an almost infinite variety of equipment. The problem, due to the large number of customers in this group, is originally one of selection rather than a helter-skelter attempt to cover the complete field. It seems to me that it requires the application of the same old principles:

First—What part of the market is easiest and cheapest to sell?

Second—How can we best approach our market under existing local conditions, whatever they may be?

Third—What special sales activities must we use in planning and carrying out this method of approach?

We are all rather queer people, we salesmen. We

seem to thrive best on campaigns and on specialized effort carried out enthusiastically over relatively short periods of time. It is very difficult for us, and, when you are enlisted to help us in all-employee selling campaigns, it is difficult for you also, continuously and enthusiastically, steadily and consistently, to go forward, except over short periods during which there are some special incentives. Perhaps planned campaigns are the best tools in the salesman's kit. Let us be sure that we use them.

For example, would it not be a marvelous thing for the electrical industry as a whole if, next fall, every electric utility in the United States, for a period of four, six or eight weeks, would intelligently campaign the sale of light? Everybody has been economizing on the use of light in the home, in the office, or store, in the factory, on the farm, even in connection with signs. It is not an automatic use of electricity—it is entirely controlled by human operation of a switch. When economic pressure comes it is a very easy thing to remember to turn off the light. True, eyesight suffers; sometimes health suffers; often money that might have been spent for light is spent for something else that does not bring to the user a fraction of the convenience and comfort that light provides. But light has been used with too great economy, our income has reflected this condition and we are not happy about it.

Why not resell electric light?

Is there any one thing that the utility industry could do as a whole that would bring back revenue more quickly than, over a sustained period, to resell the entire general public the value of the use of light? The American people, today as always, will spend money to obtain value. Forced economy has made millions of people forget the value of light. Why not a national selling campaign on light next fall—each utility doing its own job in its own territory, in whatever is the best way in that territory; every utility employee in the United States, regardless of his department, out-reselling his neighbors on the value of light; every power salesman in the United States, for a period of four to eight weeks, selling light to industry as his primary job, and power uses as his secondary job; every salesman contacting small commercial customers, concentrating on light for illumination, for windows, for signs, for floodlighting; every appliance salesman never forgetting to sell a higher-wattage light bulb to every prospect or customer? Would it not be possible for every one of us to go home from Chicago and to get under way, in conjunction with his other local outlets, with the manufacturers and with the distributors, a major campaign on lighting?

▼

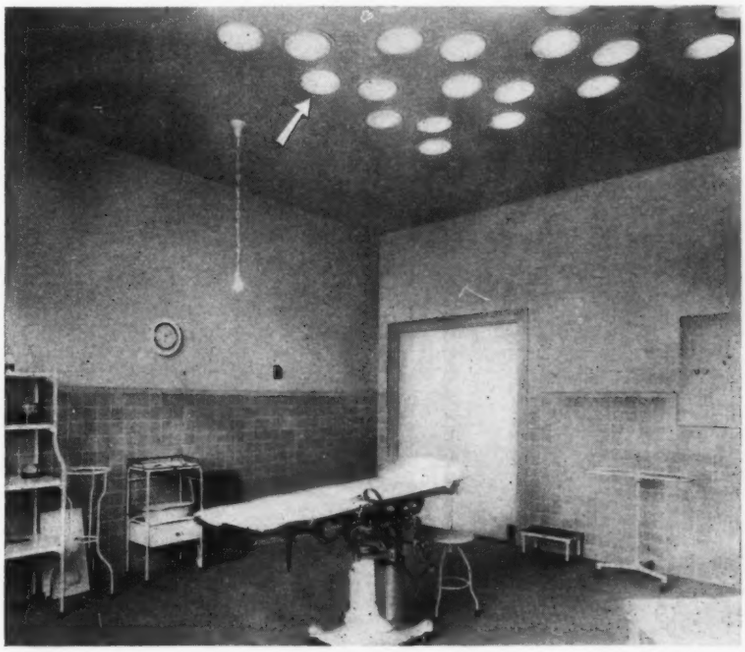
Economical Service from Electrolytic Cells

Two hundred and forty Nelson electrolytic cells are used at the Temiskaming, Que., plant of the Canadian International Paper Company to produce chlorine and caustic. According to John Hedalen, who related his experiences therewith before the Electrochemical Society recently, these cells are most satisfactory on account of simplicity of construction, durability, efficiency and economy. When properly run they will give an energy efficiency of 53 per cent. The cell body will last about twenty years when properly insulated and leakage is remedied promptly. The cathode sheets last $3\frac{1}{2}$ years when the brine is properly acidified. An average of 30 months' life is being obtained from treated graphite anodes, of which there are fourteen per cell. The diaphragms, composed of two layers of asbestos paper and one layer of asbestos cloth, average eight months' operation. But to get such long usage it is necessary to use very thin asbestos paper and thoroughly purified brine.

To obtain the energy efficiency cited, the author said, it is important to watch cell flow. While this can be regulated by intermittent admission of small quantities of steam to the cathode compartment, the rate of percolation can be more satisfactorily maintained by proper brine treatment, selection of right kind of asbestos paper and regulating the temperature of the entering brine. Damage to the diaphragm can be prevented during shutdown by completely emptying the cell, twice filling with water for one hour and draining, and then allowing water to run through the cell for 24 hours.

▼

Shadowless Lighting in Surgery



Intensive illumination without shadows is obtained in the operating room of the Lincoln (Neb.) Methodist Hospital by the use of 43 recessed lighting units located in the ceiling above the table, each equipped with a 200-watt lamp and Curtis X-ray reflector. An intensity of about 750 foot-candles is provided on the patient's body with 30 units in service and a general illumination of 200 foot-candles when only thirteen units are in circuit.

Thermostats Protect Motors in Severe Industrial Service

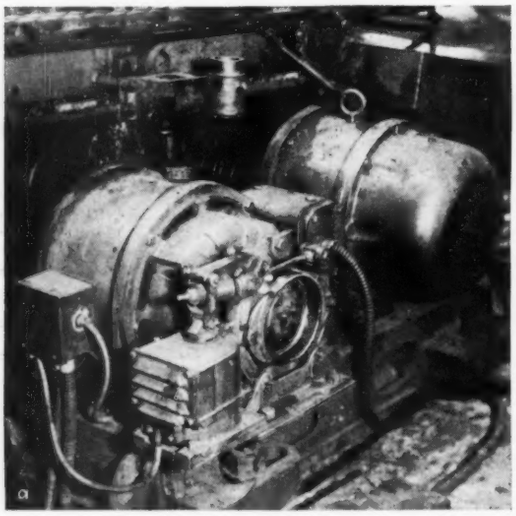
By R. S. ELBERTY

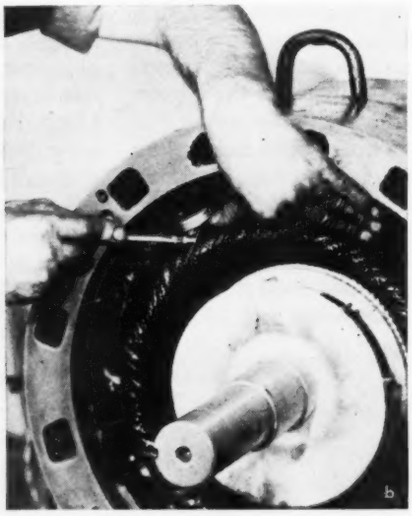
Industrial Engineer
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

AN ELECTRIC MOTOR in itself may not have a high replacement cost. However, when the motor is applied to a machine the replacement cost of the motor is not the only expense involved when the motor fails. The delay in installing the new motor, the interruption of an entire manufacturing process due to the shut-down of one machine and the possible loss of partially manufactured product are all items of expense that accompany the breakdown of electrical equipment driving and controlling machinery. Where a motor is mounted on an important machine, or is used in a critical point in a manufacturing process, the motor should have complete, accurate overload protection.

Ideal thermal protection for motors would disconnect the motor when it has reached its maximum safe operating temperature. Such a device should have a heating characteristic duplicating the motor heating condition, and recent engineering developments make it possible to mount a thermostat on the motor itself. Such a thermostat is directly affected by motor temperature and is influenced by all the conditions that influence the motor. The success of such an application depends on the dependability of the thermostat. The thermostat should not be affected by vibration. It should have a non-arcing quick-make, quick-break mechanism.

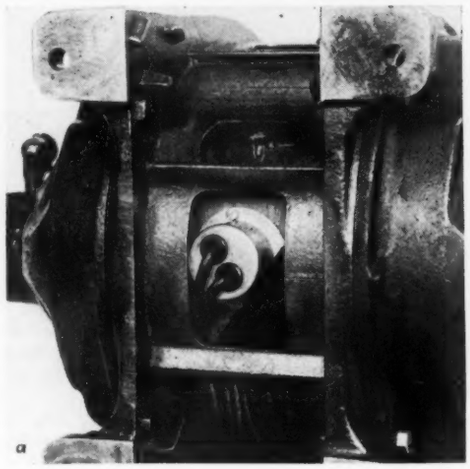
External overload relays satisfactorily protect motors applied to conventional loads, but are not affected by changes in the motor ambient temperature or ventilation failure. These overload relays operate on motor amperes and against excessive overloads such as a stalled motor condition, but they do not provide sufficient thermal capacity to permit motors to be used on certain types of loads and furnish adequate protection under all conditions. Due to space requirements, a thermostat cannot be applied in the motor slots. In mounting a thermostat near the hottest spot of the motor a temperature gradient exists between the hottest spot and the thermostat. This gradient can be compensated for under most overload conditions, but in order to protect the motor under stalled conditions the external thermal relay, or some device actuated by motor current, is also necessary.

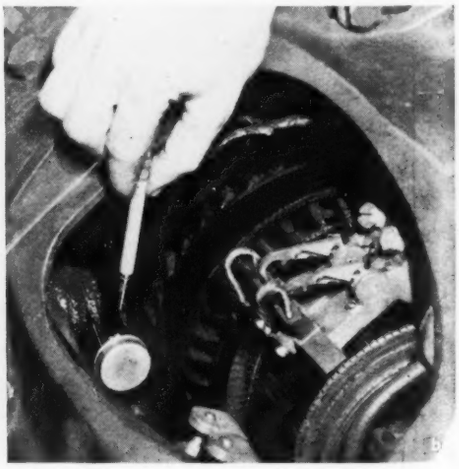




Sheet-catcher motor thermostatically protected

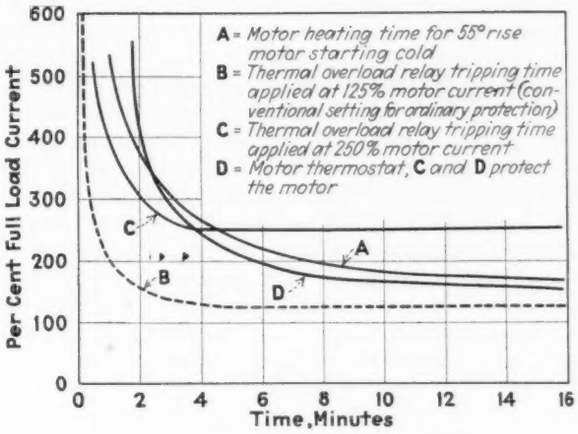
(a) These are totally inclosed, fan-cooled motors built for special reversing service. Thermostat mounted as shown in (b)





Thermostat placed in critical position

(a) On induction motors the thermostat is bolted against the active iron. (b) For d.c. applications the thermostat is mounted on the series interpole winding.



Overload relay well supplemented by motor thermostat

Motor thermal capacity compared with overload relay performance. Relay-curve B (conventional setting for protection) does not permit motor to start heavy loads. Relay-curve C does not protect motor under running conditions and must be supplemented by a motor thermostat in order to protect the motor completely. By combining a motor thermostat with the overload relay the motor is completely protected under all load conditions since curves C and D combine to fall below curve A.

Where it is desirable to mount thermostats on existing motors the application should be made by the motor manufacturer. For such an application a detailed knowledge of the motor design is necessary and the motor manufacturer should have the responsibility for correctly installing the thermostat.

When a motor is driven backward both electrical and mechanical energy are fed into it. The mechanical energy is furnished by the driven load and depends largely on the inertia of the driven load and the motor. An external overload relay that measures electrical energy alone cannot measure all of the energy supplied to a motor operated under such conditions. The external overload relay should be supplemented by a motor thermostat where motors are reversed frequently, or where high inertia loads are braked by means of plugging.

Motors used on steel mill roll tables, steel mill screw downs, sheet catchers, laundry and dry cleaning washers, planers, tapping machines, cranes, hoists, blooming mill manipulators and similar applications should have the additional protection furnished by a built-in thermostat.

Short-time rated motors require thermostat protection

Motors rated for short-time service are used on motor-operated valves, hoists, machine tool clamp and traverse operations, material-handling machinery and similar applications. Such motors carry rated current for periods exceeding the time-current characteristic of the ordinary thermal overload relay, but they may reach destructive temperatures if they carry load continuously. A motor thermostat in such cases will protect the motor completely and still permit it to be operated to its fullest capacity.

High inertia loads are obtained with flywheel presses, centrifugals and similar machines. This type of load requires considerable power for acceleration and the effective motor-starting currents are considerably higher. Standard overload relays will not permit these motors to start and special current transformers are ordinarily inserted in the control circuit to minimize the effect of the starting load. This type of protection is a compromise and does not protect the motor if it is started too frequently or under abnormal starting loads.

On such loads a motor thermostat will protect against

Thermostats Prevent Motor Overheating from Various Causes

Industry and Application	Too Frequent Starting	Frequently Repeated Overloads	High Room Temperatures	Abnormal Voltage	Phase Unbalance	Dust Covered Windings	Ventilation Failure
Food Plants							
Grinders	..	*	..	*	..	*	*
Dough mixers	..	*	..	*	..	*	*
Sugar centrifugals	*	..	..	*	..	..	*
Pumps	..	*	..	*	..	..	*
Petroleum							
Centrifugals	..	*	..	*	..	..	*
Drilling	..	*	..	*	..	..	*
Pumping	..	*	..	*	..	..	*
Cement							
Conveyors	..	..	*	*	..	*	*
Elevators	..	..	*	*	..	*	*
Screens	..	..	*	*	..	*	*
Feeders	..	..	*	*	..	*	*
Textile							
Cloth printing	..	..	..	*	..	..	*
Frequency changers	..	..	..	*	*	..	*
Dye machines	..	..	*	*	..	..	*
Building							
High inertia fans	*	..	..	*	..	..	*
Induced draft fans	..	..	*	*	..	..	*
Elevators	..	*	..	*	..	..	*
Hoists	..	*	..	*	..	..	*
Door operators	*	..	..	*	..	..	*
Dumbwaiters	..	*	..	*	..	..	*
Steel Mills							
Auxiliaries	..	*	*	*	..	..	*
Sheet catchers	..	*	..	*	..	..	*
Roll tables	..	..	..	*	..	..	*
Shears	..	*	..	*	..	..	*
Tube piercing	..	*	..	*	..	..	*
Electro-chemical							
Centrifugals	..	*	..	*	..	..	*
Crushers	..	*	..	*	..	..	*
Agitators	..	..	*	*	..	..	*
Electrode motors	*	*	..	*	..	..	*
Furnace tilting	..	*	..	*	..	..	*
Materials Handling							
Drag lines	..	*	..	*	..	..	*
Dredges	..	*	..	*	..	..	*
Shovels	..	*	..	*	..	..	*
Skip hoists	..	*	..	*	..	..	*
Ballast cleaner	..	*	..	*	..	..	*
Mining							
Scraper hoists	..	..	..	*	..	..	*
Coal saws	..	*	..	*	..	..	*
Leading machines	..	*	..	*	..	..	*
Mining drills	..	*	..	*	..	..	*
Locomotives	..	*	*	*	..	..	*
Machine Tool							
Chip extractor	*	*	..	*	..	..	*
Punch press	*	*	..	*	..	..	*
Power shear	*	*	..	*	..	..	*
Clamp operator	..	..	..	*	..	..	*
Bending rolls	*	*	..	*	..	..	*
Lathes	..	*	..	*	..	..	*
Milling machine	..	*	..	*	..	..	*
Boring mills	..	*	..	*	..	..	*
Laundry							
Extractors	*	*	..	*	..	..	*
Ironers	..	*	*	*	..	..	*
Washers	..	*	..	*	..	..	*
Tumblers	..	*	*	*	..	*	*
Rubber mills							
Tire machines	..	*	..	*	..	..	*
Mill lines	..	*	..	*	..	..	*
Paper Mills							
Synchro-tie units	..	*	..	*	*	..	*
Sectional drive	..	..	..	*	..	..	*
Single drive	..	..	..	*	..	..	*
Auxiliaries	..	*	..	*	..	..	*
Frequency changers	..	..	..	*	*	..	*
Chippers	..	*	..	*	..	..	*

motor overheating, and the external overload relay can be set high enough to permit the motor to start and still protect against stalled motor conditions. Saturated current transformers need not be used and the motor can be completely protected if exact operating conditions are known.

Fractional-horsepower motor circuits directly opened

On fractional-horsepower motors the voltage is low and the current handled is small. Heaters carrying motor current may be combined with motor thermostats and the thermostat itself may be used to interrupt the motor circuit directly. This type of built-in thermostat provides an economic, non-tamperable motor-protective device. Motors so protected save wiring costs and have a large field of application on appliances and small machinery.

The built-in thermostat protection is widely used on domestic refrigerator motors. Tests have been made with such a motor completely stalled on the line for months at a time without damage to the motor windings or to the capacitor. A similar type of protection is used on gasoline pump motors. These motors must be explosion proof, and the use of a built-in motor-starting switch and overload protection greatly simplifies the installation and offers considerable economy in wiring the pump.

There are a number of accidental conditions that can happen to any motor to cause it to burn out and which do not ordinarily affect an external overload relay. The motor ambient temperature may be excessive or motor ventilation may fail due to obstructed air passages, fan failure, accumulation of dust on the motor windings. Any motor is subject to these conditions and no protective means removed from the motor itself can guard against such accidents.

In case of bearing wear, the armature or rotor of a motor may rub without actually stalling the motor. This rubbing generates heat rapidly and a motor can be badly damaged under such conditions if it is not shut down. A motor thermostat may take care of such a condition where external protection is usually unsatisfactory.

▼ ▼ ▼

Large Hydro Unit Adapted for Sensitive Governing

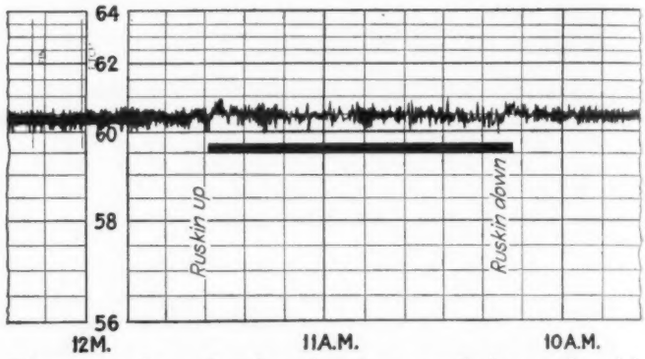
By A. N. GEYER

Woodward Governor Company, Seattle, Wash.

Recent improvements to the governor of the 42,500-hp. unit installed in 1930 at the Ruskin plant of the British Columbia Electric Railway Company have made possible unusually close frequency regulation despite the fact that load conditions on the system rarely require the operation of stand-by steam plants. This company has an appreciable load from the operation of its street cars and interurban system, a load that inherently is subject to sudden changes. Abundant water for hydroelectric generation has been available during the past few years and, in consequence, these load changes have to be taken on the hydro units. To conform with the exacting frequency requirements of modern service, governor sensitivity beyond that usually expected of hydraulic governors was required and accordingly the Ruskin unit was selected to control the frequency of the system.

As originally installed three years ago, this unit was controlled by a Woodward type A-21 actuator type governor which was interlocked with the complete protective relay system of the plant. New developments added to further increase its sensitivity and speed of action under fluctuating system loads included more sensitive fly-balls, a small-lap pilot valve and the new direct-connected type of relay valve in which the relay valve operating cylinder is directly above, with the operating piston directly on the relay valve stem extended. In addition, an auxiliary by-pass on the compensating dashpot was installed to give more freedom of movement under load. With these new features, the governor showed greater activity, responding to quick load changes in much the same manner as the conventional steam governor. Unlike the latter, is its ability to maintain a constant average frequency for all loads.

Illustrative of the results obtained from these improvements is the accompanying frequency chart. Studies of charts taken over periods of longer duration show that when the Ruskin governor is so sensitive the load changes during periods of light system load are absorbed without causing the frequency record to deviate from a straight line. As the railway load becomes more predominant, the record broadens due to the reason described above. However, speed fluctuations which formerly would swing three-quarters of a cycle have been reduced to an average of one-quarter cycle. Furthermore, the average frequency is maintained within exceptionally close limits with the new design, for the regulator has been adjusted to a non-drooping characteristic curve. This enables operators to maintain correct electric clock indications with only infrequent manual adjustment of the governor. The accuracy and regulation of the new governor is indicated by the fact that these adjustments are of the nature of those regularly made to the pendulum of a master clock to adjust it for the best timekeeping.



Frequency chart showing the close regulation and quick response possible with a modern governor controlling a large hydro unit

Early in the morning Ruskin was governing the system, but about 10:20 a.m. the governor became inactive by running against the load limit stop. This was attended by a noticeably larger departure in frequency variation from normal, but when the governor was restored to normal service at 11:30 it will be seen that the frequency band again became narrowed. The more solid line then recorded indicates a recurring movement that is caused by the over-travel of the less sensitive governors of the other hydro units on the system.

Primary Network Economical for Medium-Load Densities

By JOHN S. PARSONS and LEONARD M. OLMSTED

Distribution Engineers
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

A PREVIOUS article* compared the overhead secondary network with other types of distribution systems used in medium-load density areas. With all circuits, including 13.2 kv. transmission, of open-wire construction, the secondary network showed economies at densities above 2,300 kva. per square mile. When both the transmission and primary distribution circuits were underground the secondary network proved cheaper than either the primary network or the 4-kv. radial system throughout the entire range of densities studied. Many systems, however, use underground or aerial-cable transmission in conjunction with overhead 4-kv. and secondary circuits. The present article presents the results of a similar analysis for these latter conditions, which indicate that the primary network is economical throughout practically the entire medium-density range.

Such areas are customarily served by pole-mounted distribution transformers and open-wire secondaries. To avoid the complication of separate light and power circuits both this and the previous study assume three-phase transformers and 120/208-volt, four-wire secondaries for all systems. While this is admittedly an approximation, any error introduced thereby can affect only the relative comparison of the overhead secondary network with the other four systems and should be negligible at the heavier densities for which the secondary network becomes attractive.

The present study assumes 4-kv. circuits of four-wire, overhead construction and (1) 13.2-kv. transmission underground; consideration is also given to the use of aerial cable to eliminate heavy expenditures for duct and manhole construction, either (2) for lateral transmission to both primary and secondary networks, with the main circuits still underground, or (3) for all transmission circuits. The earlier study indicated that adapt-

*"*Overhead Secondary Network Offers Real Economy,"* ELECTRICAL WORLD, *May 7, 1932, pages 808-813.*

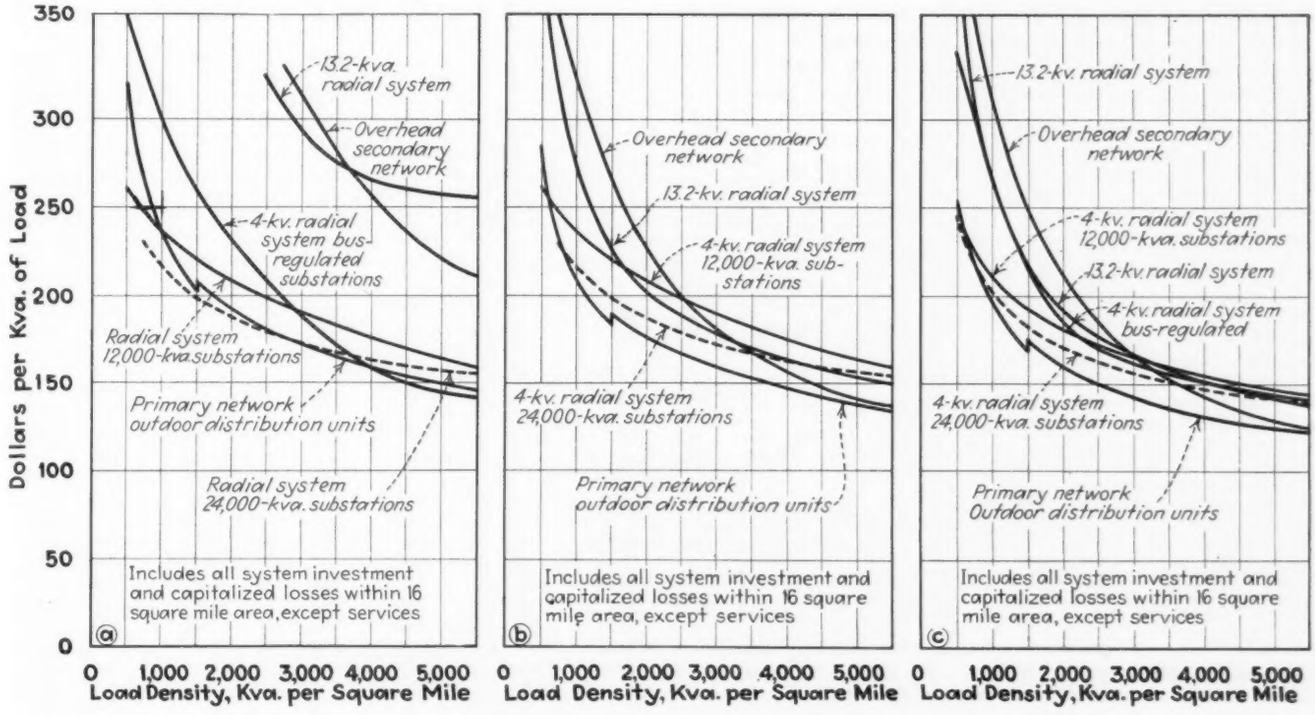

Dollars per Kva. of Load
350
300
250
200
150
100
50
0
13.2-kva. radial system
Overhead secondary network
4-kv. radial system bus-regulated substations
Radial system 12,000-kva. substations
Primary network outdoor distribution units
Radial system 24,000-kva. substations
Includes all system investment and capitalized losses within 16 square mile area, except services
(a)
0 1,000 2,000 3,000 4,000 5,000
Load Density, Kva. per Square Mile
Overhead secondary network
13.2-kv. radial system
4-kv. radial system 12,000-kva. sub-stations
4-kv. radial system 24,000-kva. substations
Primary network outdoor distribution units
Includes all system investment and capitalized losses within 16 square mile area, except services
(b)
0 1,000 2,000 3,000 4,000 5,000
Load Density, Kva. per Square Mile
13.2-kv. radial system
Overhead secondary network
4-kv. radial system 12,000-kva. substations
13.2-kv. radial system
4-kv. radial system bus-regulated
4-kv. radial system 24,000-kva. substations
Primary network Outdoor distribution units
Includes all system investment and capitalized losses within 16 square mile area, except services
(c)
0 1,000 2,000 3,000 4,000 5,000
Load Density, Kva. per Square Mile

Fig. 1—Cost per kva. of distribution systems compared for growing load conditions

(a) Transmission circuits underground cable in ducts; 4-kv. circuits and secondaries open-wire construction. Uniform load density and load growth of 10 per cent per year assumed.

(b) Main transmission circuits underground cable in ducts, lateral transmission aerial cable; 4-kv. circuits and secondaries open-wire construction. Uniform load density and load growth of 10 per cent per year assumed.

(c) Transmission circuits aerial cable; 4-kv. circuits and secondaries open-wire construction. Uniform load density and load growth of 10 per cent per year assumed.

ability to growth is a decided factor in establishing the relative economic merits of the various systems of distribution. Accordingly this discussion is confined to systems designed for growth at the rate of 10 per cent per year.

Primary network shows cost advantage

When transmission circuits are underground cable in ducts the 4-kv. radial system using 24,000-kva. feeder-regulated substations is slightly less expensive than the primary network up to approximately 2,900 kva. per square mile. This slight economic advantage, however, is likely to more than disappear under actual conditions, where the load density is not uniform and the locations and magnitudes of the loads to be served in the future are unknown, because long before a station of this size is loaded it may be a considerable distance from the load center. Reference to Fig. 1a shows that the primary network is appreciably lower in cost than the 12,000-kva. substation system at densities above 1,000 kva. per square mile. The bus-regulated radial system also shows economies at the higher densities.

Use of aerial cable for lateral transmission to the network units materially lessens the cost of both the primary and the overhead secondary network. In Fig. 1b the primary network is shown to be most economical throughout essentially the entire range of densities, closely approached above 4,500 kva. per square mile by the overhead secondary network.

Fig. 1c shows the curves for the same systems with all transmission by aerial cable. Here, too, the primary network shows less expenditure than any other system, closely approached again at the higher densities by the overhead secondary network.

The five types of distribution systems studied were: 4-kv. feeder-regulated radial, 4-kv. primary network, 4-kv. bus-regulated radial, overhead secondary network fed over 13.2-kv. transmission and 13.2-kv. radial. Each

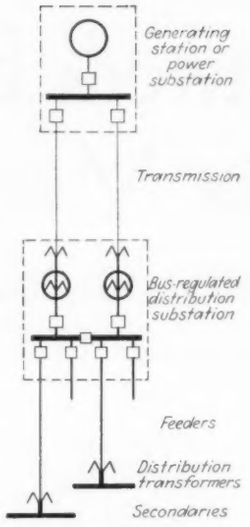


Fig. 2—4-kv. bus-regulated radial system

system was carefully laid out to serve the 16-square mile load area and was expanded as required to carry the growing load. The total system investment within the area to the consumers' services was then estimated for each year. From these data curves were plotted showing system investment per kva. of system peak against the load density. To these curves were added approximate capitalized losses taken from static load studies. This sum of system investment plus capitalized losses per kva. has been plotted against load density in the form of smooth curves in order to facilitate comparison between systems. These curves are the ones shown in Fig. 1 a, b and c and a table giving detailed cost figures and capitalized losses for a number of densities covered by the curves has been included to show just where in the various systems the cost differences occur.

The 4-kv. radial system, using feeder-regulated substations, is at present the most common type of distribution system and forms a basis of comparison for the newer systems. Investigation of the economic size of substation for the conditions covered in the earlier article showed little choice between 12,000- and 24,000-

Analysis of Distribution Systems

(Study Based on 4-Mile Square with Uniform

	4-Kv. Radial System, Feeder-Regulated Substations; 13.2-Kv. Transmission Underground; 4-Kv. and Secondary Circuits Open-Wire			4-Kv. Radial System, Bus-Regulated Substations; 13.2-Kv. Transmission Underground; 4-Kv. and Secondary Circuits Open-Wire			4-Kv. Primary Network, 1,500-Kva. Units with Air-Blast Rating 2,000-Kva.; 13.2-Kv. Transmission Underground; 4-Kv. and Secondary Circuits Open-Wire			4-Kv. Radial System, Feeder-Regulated Substations; 13.2-Kv. Transmission Aerial Cable; 4-Kv. and Secondary Circuits Open-Wire		
System load, kva. per sq. mile	750	1,500	4,500	750	1,500	4,500	750	1,500	4,500	750	1,500	4,500
Average substation size, kva.	12,000	12,000	12,000	3,000	4,000	10,000	....	....	.....	12,000	12,000	12,000
Number of primary distribution units	.....	.....	.....	....	....	.....	12	22	58	.....	.....	.....
Average secondary conductor size, number	2	2	1	2	2	1	2	2	1	2	2	1
Average distribution transformer size, kva.	15	17	26	15	17	26	15	17	26	15	17	26
(Costs in thousands of dollars)												
Transmission within area	117	332	905	246	485	860	238	418	1,010	106	322	880
Substations	362	780	2,260	517	1,030	1,800	....	....	.....	362	780	2,260
Primary distribution units	.....	.....	.....	....	....	.....	360	660	2,030	.....	.....	.....
Distribution transformers and accessories	525	946	2,110	525	946	2,110	525	946	2,100	525	946	2,100
Distribution transformers, protectors and accessories	.....	.....	.....	....	....	.....	....	....	.....	.....	.....	.....
4-Kv. circuits	404	520	924	432	649	1,050	270	290	347	404	520	924
Secondary circuits	330	411	805	330	411	805	330	411	805	330	411	805
Poles	514	575	782	512	575	640	490	565	745	525	610	840
Ducts and manholes	162	421	696	391	614	770	555	742	1,780	.....	.....	.....
Changeover expense	33	107	246	33	107	246	33	107	246	33	107	246
Investment in area	2,447	4,092	8,728	2,986	4,817	8,281	2,801	4,139	9,073	2,285	3,696	8,065
Main transmission outside area in excess of secondary network	0	240	1,200	480	720	240	0	0	0	0	156	780
Induction regulators on 13.2 kv. for overhead secondary network and 13.2-kv. radial	.....	.....	.....	....	....	.....	....	....	.....	.....	.....	.....
Total investment	2,447	4,332	9,928	3,466	5,537	8,521	2,801	4,139	9,073	2,285	3,852	8,845
Capitalized losses	510	940	2,270	413	654	2,180	393	710	2,040	425	770	1,960
Total cost	2,957	5,272	12,198	3,879	6,191	10,701	3,194	4,849	11,113	2,710	4,622	10,805
Cost per kva. peak load (dollars)	246	220	169	324	258	149	266	202	154	226	193	149

kva. stations rated on the basis of load capacity. For the present conditions, however, transmission cost becomes of relatively greater importance and the 24,000-kva. station gives a lower total system cost for the range of densities considered. This, however, is probably a larger station than would be practical for many applications. The cost of the system for 24,000-kva. substations runs from 10.5 to 3.3 per cent less than for 12,000-kva. substations. The larger savings apply to 13.2-kv. underground transmission cable and the smaller to aerial cable, in both instances for 4-kv. radial open-wire circuits from feeder-regulated substations.

Air blast provides emergency capacity

Primary distribution units of the outdoor type were used in the primary network system. Each unit consists of a 1,500-kva., three-phase automatic load tap-changing transformer and a five-breaker switchgear structure, with the necessary auxiliary equipment. When any one of the transmission circuits feeding the network is de-energized the load dropped by its associated distribution units must be picked up by the units remaining in service. This load, of course, will not divide equally among the remaining units, but will pile up on those nearest the units out of service. Sufficient spare capacity has been allowed to avoid overloading any part of the system under this condition. Much of this spare capacity is secured by the use of air-blast equipment on all of the 1,500-kva. units to give a 2,000-kva. air-blast rating. Under normal conditions no transformer is loaded to more than 1,500-kva., therefore the air-blast is operated only during emergencies.

In the economic studies previously reported air-blast equipment was not employed. Its use, for the condition of all circuits open-wire, reduces the total cost of the primary network by approximately 7 per cent, so that the overhead secondary network becomes the most economical system at about 2,800-kva. per square mile instead of 2,300-kva. per square mile as is the case when air-blast is not used. In the case of all circuits except the secondaries underground the savings secured by using air-blast on the primary network transformers is not nearly sufficient to overcome the economies of the overhead secondary network.

In the bus-regulated radial system using aerial-cable transmission 2,000-kva., three-phase transformers are employed. Each transformer is connected by an oil disconnect to a 6,000-kva., 13.2-kv. transmission circuit and supplies a 4-kv. bus section through a 10 per cent buck-or-boost induction regulator. If preferred, the regulator may be replaced by automatic load tap-changing equipment mounted on the transformer. Two radial feeders are connected to the 4-kv. bus section through automatic reclosing breakers. Depending upon the density of the load to be served, from two to five of these units, each fed over a different transmission circuit, are located in a substation with the bus sections normally tied through sectionalizing breakers. For underground transmission a similar design is used except that the transformers are 3,000-kva., three-phase and three 4-kv. feeders radiate from each bus section. This type of system is indicated in Fig. 2.

Since load is tapped off along the feeders, care must be exercised in loading to keep the voltages at the services near the two ends of each feeder within accepted limits of regulation. Because of this, both the length and the loading of the circuits are definitely restricted. The load carried per feeder is materially less than in the feeder-regulated radial system, and reliability of service is thereby improved.

This work shows that the primary network has real

Serving Medium Density Areas

Load Density Growing 10 Per Cent per Year)

4-Kv. Radial System, Bus-Regulated Substations; 13.2-Kv. Transmission Aerial Cable; 4-Kv. and Secondary Circuits Open-Wire			13.2-Kv. Radial System; 13.2-Kv. Transmission Aerial Cable; Secondary Circuits Open-Wire			4-Kv. Primary Network; 1,500-Kva. Units with Air-Blast Rating 2,000-Kva.; 13.2-Kv. Transmission Aerial Cable; 4-Kv. and Secondary Circuits Open-Wire			Overhead Secondary Network; 13.2-Kv. Transmission Aerial Cable; Secondary Circuits Open-Wire			13.2-Kv. Radial System; 13.2-Kv. Main Transmission Underground, Lateral Transmission Aerial Cable; Secondary Circuits Open-Wire			4-Kv. Primary Network; 1,500-Kva. Units with Air-Blast Rating 2,000-Kva.; 13.2-Kv. Main Transmission Underground, Laterals Aerial Cable; 4-Kv. and Secondary Circuits Open-Wire			Overhead Secondary Network; 13.2-Kv. Main Transmission Underground, Laterals Aerial Cable; Secondary Circuits Open-Wire		
750	1,500	4,500	750	1,500	4,500	750	1,500	4,500	750	1,500	4,500	750	1,500	4,500	750	1,500	4,500	750	1,500	4,500
2,000	3,800	5,500	....	....	.....	....	....	....	....	....	....	....	....	....	....	....	.....	....	....	.....
.....	....	.....	....	....	.....	12	22	58	....	....	....	....	....	....	12	22	58	....	....	.....
2	2	1	2	1	1/0	2	2	1	3/0	3/0	3/0	2	1	1/0	2	2	1	3/0	3/0	3/0
15	17	26	15	18	29	15	17	26	45	45	62	15	18	29	15	17	26	45	45	62
362	645	1,094	1,360	1,450	2,045	244	448	1,100	1,100	1,695	2,830	1,360	1,520	2,200	238	437	1,028	1,005	1,666	2,791
647	1,005	2,210	....	....	.....	....	....	....	....	....	....	....	....	....	....	....	.....	....	....	.....
.....	....	.....	....	....	.....	360	660	2,030	....	....	....	....	....	....	360	660	2,030	....	....	.....
525	946	2,110	1,100	2,060	4,310	525	946	2,110	....	....	....	1,100	2,060	4,310	525	946	2,110	....	....	.....
.....	....	.....	....	....	.....	....	....	....	837	1,580	3,440	....	....	....	....	....	.....	837	1,580	3,440
490	580	1,060	....	....	.....	270	290	347	....	....	....	....	....	....	270	290	347	....	....	.....
330	411	805	330	469	1,082	330	411	805	1,442	1,442	1,442	330	469	1,022	330	411	805	1,442	1,442	1,442
562	672	915	507	553	655	527	627	840	611	645	800	507	546	640	502	587	814	602	671	740
.....	....	.....	....	....	.....	....	....	....	....	....	....	0	48	298	178	319	1,048	171	444	934
33	107	246	33	98	219	33	107	246	....	....	....	33	98	219	33	107	246	....	....	.....
2,949	4,266	8,440	3,330	4,630	8,311	2,269	3,489	7,478	3,990	5,362	8,512	3,330	4,741	8,749	2,436	3,757	8,428	4,057	5,803	9,347
312	156	312	0	0	468	0	0	0	....	....	....	0	0	720	0	0	0	....	....	.....
.....	....	.....	76	152	418	....	....	....	76	152	361	76	152	418	....	....	.....	76	152	361
3,261	4,422	8,752	3,406	4,782	9,197	2,269	3,489	7,478	4,066	5,514	8,873	3,406	4,893	9,887	2,436	3,757	8,428	4,133	5,955	9,708
352	700	1,800	344	477	1,328	344	594	1,650	218	430	910	344	500	1,500	372	685	1,885	220	432	930
3,613	5,122	10,552	3,750	5,259	10,525	2,613	4,083	9,128	4,284	5,944	9,783	3,750	5,393	11,387	2,808	4,442	10,313	4,353	6,387	10,638
301	214	147	312	219	146	218	170	127	357	248	136	312	224	158	234	185	143	362	266	148

economic merit and indicates the general field of economic application. The use of a network system, either primary or secondary, reduces the amount of system planning required and eliminates much of the necessity for guessing when and where future loads will have to be taken. The primary network can be readily used to take care of future growth on existing distribution systems. Also, when changing a radial system to a primary network, much of the existing system can be used, thus keeping down the expense of changeover. Both the primary network and the bus-regulated radial systems are particularly well adapted to use complete factory-built distribution units.

A general analysis of this kind cannot be expected to eliminate the necessity for making economic studies of actual cases, because of the variations in conditions and costs in different localities. It should serve as a guide, however, in determining what system or systems merit consideration and thus eliminate much work. While the overhead secondary network and the primary network show more economic promise than the other systems in most of the cases considered, it can be concluded definitely from these studies that there is no one type of distribution system which will prove most economical for all conditions that may be encountered.

▼

Effect of Power-Factor Correction on Demand Charges

The possibility of securing savings from power-factor correction beyond the reduction in investment charges on motor and control equipment resulting from industrial plant betterments along this line have recently been investigated by Brooks Faxon, Boston, Mass., in analyzing the Plymouth Motor Car Company's successful control of power factor as described in the ELECTRICAL WORLD, March 11, 1933, page 330.

Mr. Faxon assumed that the Plymouth Motor Car Company operates its own power plant, from the material presented in the foregoing article, and that it was accordingly satisfied with the large financial return obtained in the cutting down of its investment charges. Looking at the further savings which would have been achieved in case electricity was purchased from an outside source under an average yearly demand rate of $12 per kva., the following analysis was set forth:

From the context of the foregoing article it is safe to assume that the original 704 motors of the Plymouth plant, totaling 1,710 hp. in combined rating, were operating at a load factor of around 50 per cent. Allowing 83 per cent motor efficiency and 68 per cent power factor for the original installation the demand becomes 769 kw. (1,131 kva.) and the reactive kva. becomes 829.

After making the changes to improve the power factor the industrial plant still had 704 motors (with changes to smaller sizes) totaling 878 hp. in service. As the work done in each machine did not change, but as the motor efficiency increased, the demand was reduced to 741 kw., but 391 reactive kva. was eliminated, the resulting reactive kva. totaled 438 and the kva. demand became 860, making the new power factor 86 per cent.

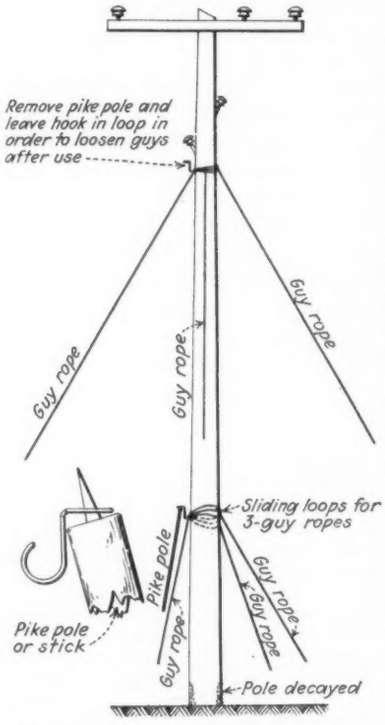
Therefore from the above there is realized a direct demand charge saving of 1,131 minus 860 or 271 kva., which at $12 per kva. per year gives the very attractive saving of $3,252 per annum for the small capital outlay of $3,130 for new motors and labor. Mr. Faxon pointed out that had any utility manager had such a load on his lines he would gladly have had his customer make such a change in equipment, even though this might mean giving up an immediate revenue of $3,252; for the utility could have taken this same released 271 kva. and sold the service it represents at $50 per horsepower-year to other customers on a highly profitable basis ($11,802 revenue).

▼

Safety Guy Hook

By G. E. CALLAHAN

Appalachian Electric Power Company, Bluefield, W. Va.



Hook makes temporary guying a safe job

No lineman worthy of his trade ever works on a "bad" pole without first tying it up with a set of temporary guys. But he has to climb the pole to put the rope guys in place, taking a chance that the pole will hold him until the ropes are tightened. At least he had to take that chance before, but he does not have to now, if he will use the safety guy hook described here. This hook, as shown in the drawing, is a simple affair, a piece of $\frac{3}{8}$-in. rod bent into shape with a 1-in. horizontal ring above the curve of the hook. This hook may be made from a tie wire or any other stiff wire on the job. Any long stick will do to raise it. All that is necessary is the hand lines and the desire to be safe. The ring is slipped over the spike of a pike pole and the loose loop of the guy rope is held in the hook while it is pushed up as high as necessary on the pole and tightened in place. The pike is then dropped out of the ring, leaving the hook under the loop, where it can be used to loosen the rope guy when the work is finished.

▼

Author's Name Bayle, Not Boyle

In the article "Billet Scale Removed with Relay-Controlled Spray," in the June 3, 1933, issue of ELECTRICAL WORLD (page 723), the author's name appeared as R. M. Boyle, due to a regrettable typographical error. The author's name is R. M. Bayle.

BOOK REVIEWS

Modern Industrial Organization

By H. Von Beckerath. Published by the McGraw-Hill Book Company, 330 West 42d Street, New York, N. Y. 385 pages. Price, $4.

This book deals with manufacturing operations and considers objectively the machine age, the development and limitations of mass production and standardization and the rationale of advertising. The author is German and the background is that of modern industry in that country, but the industrial characteristics of the leading nations are examined and discussed without bias. This is an interesting and thorough treatise on modern industry with an interpretation of its action on economic and social life.

▼

Electrical Circuits and Machinery

By John H. Morecroft and Frederick W. Hehre. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York, N. Y. 457 pages, illustrated. Price, $4 plus postage.

For certain purposes the book which goes into elaborate detail at the very points where the student *thinks* he sees, but actually misses the essence, is most desirable. Morecroft and Hehre have done just this in connection with flux linkages and induction, with Kirchhoff's law circuits, with magnetic circuits. In taking pains to clinch the basic laws of circuits and machinery the authors have paved the way for a prompt arrival at the practical operating aspects of continuous current generation and utilization. (This volume of the revised edition deals only with d.c.)

Unusual in a college text, the book ends with an excellent short chapter on the care, operation and characteristic faults of d.c. machinery. Some obsolete designs are retained, presumably for purely pedagogical effectiveness, but on the whole this second edition has brought the illustrations and the reported practice up to date. One is, however, constrained to ask why in a book addressed primarily to "non-electrical" students nearly all the plentiful numerical problems are of the design type rather than of the economic application-to-the-job type which such graduates are most likely to encounter?

▼

The Engineer's Manual of English

By W. O. Sypherd and Sharon Brown. Published by Scott, Foresman & Company, New York. 515 pages. Price, $2.

Engineers will find this book a distinctly practical aid to better writing. Nowhere has it the flavor of the English professor condescending to show engineers how to emulate the literati; on the contrary, it talks the engineer's own language. It reaches all the way from the literary exercises of the technical student to the masterful presentations of the executive. Opening with a terse summary of the modern rules of grammar and composition (two chapters) the two professors from Delaware and Brown set up the business letter, the technical report, articles for journals, bulletins and specifications in precept and practice. Illustrations of good and bad technical writting form the major vehicle of exposition in these chapters. Any honest engineer will know the authors did not invent the horrible examples nor cull them from Sis Hopkins, the Garble Sisters or Harhimura Togo; none other than engineers perpetrated them.

Half the book (Part II) is devoted to samples of technical reports of various sorts; technical articles, editorials, abstracts and book reviews; subject matter for bulletins, booklets and catalogues; specifications and patents. A glossary of words commonly misspelled by engineers closes the book. If this résumé of the contents fails to serve adequately as an earned testimonial let the reviewer say he is placing the book alongside his own dictionary, style book and Thesaurus.

▼

Theory of Thermionic Vacuum Tubes

By E. Leon Chaffee. Published by the McGraw-Hill Book Company, 330 West 42d Street, New York, N. Y. 652 pages, illustrated. Price, $6.

A thoroughly developed discussion and handbook on all fields and aspects of radio engineering. It covers tubes, circuits, systems and applications under the three divisions of fundamentals, amplifiers and detectors. It is restricted to the field of low power tubes. Fundamental considerations are stressed, with mathematics used freely to arrive at quantitative results. The book is a text based on courses given at Harvard and should find a welcome in colleges and among radio engineers.

▼

Conduction of Electricity in Gases

By Joseph Slepian. Published by Educational Department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. 188 pages, illustrated. Price, $4.

It is probable that no branch of applied physics presents a greater gap between the infinitesimal laboratory magnitudes and the enormous magnitudes of engineering practice than the high-voltage, high-capacity circuit breaker. In between are corona, the spark, the glow and the invisible emission of the thermionic tube. In conjunction with his notable work on deionization of arc spaces Dr. Slepian has developed a technique of presentation of these phenomena of electrical conduction in gases that is unique. This has been available to Westinghouse engineers and research workers and also to physics students at the University of Pittsburgh. Now it is made available in book form to others.

Starting with the kinetic theory of gases, the treatment smoothly effects the transition into electronic movements and emissions and then ionization and deionization. Incidental to the laying of the theoretical foundation the author correlates the limiting characteristics of electrical devices with the mathematical analysis of space charges, gas pressures, diffusion, etc. Mobility of ions, the mechanism of ionization, time of breakdown, reignition and extinction follow. Application of these gaseous phenomena to arresters, switches, rectifiers, glow tubes, circuit breakers and other devices constitute the latter half and closure of the book.

In no sense is the book to be viewed as descriptive. It aims to present an integrated mathematical picture of conduction phenomena in gases. In no other publication known to the writer has so successful an attempt been made to detach the element of empiricism from the behavior and sound design of a wide range of practical electrical equipment devised to interrupt or perpetuate electric currents through gases or vacua.

Men of the Industry

BASIL MANLY, who represented the New York Power Authority in Washington for some time, has been selected to be a member of the Federal Power Commission.

•

R. A. MITCHELL, vice-president of the Alabama Power Company, has been made the recipient of the honorary degree of doctor of laws by the University of Alabama.

•

HERBERT J. DRANE of Florida has been confirmed by the United States Senate as a member of the Federal Power Commission.

•

THOMAS A. MARSH has become a partner in the Ernest E. Lee Company, Chicago, manufacturers' representatives. Mr. Marsh was for ten years chief engineer of the Green Engineering Company, for seven years western engineer of the Combustion Engineering Corporation and for three years president of the Modern Coal Burner Company.

•

CLAUDE M. LAMB, sales representative of the Greenfield (Mass.) Electric Light & Power Company, has been appointed to a similar position with the United Electric Light Company, Springfield, Mass. Following graduation from the Worcester Polytechnic Institute, and after a connection with the General Electric Company, he joined the staff of the Turners Falls Power & Electric Company as an operating engineer. Two years ago he was transferred to the Greenfield Electric Light & Power Company as sales representative.

•

GORDON A. LEMM, merchandise manager of the Oswego Valley district of the Niagara Hudson Power Corporation for the past year and previous to that merchandise manager for the Peoples Gas & Electric Company for 5½ years, has severed his connection with the Niagara Hudson company to take a similar position with a large electrical company in the south.

•

ARTHUR O. AUSTIN has resigned as vice-president of the Ohio Insulator Company, division of the Ohio Brass Company, Mansfield, to establish a consulting engineering practice with headquarters at Barberton. Mr. Austin will specialize in engineering work in connection with transmission and distribution of electrical energy for power and radio purposes. Following graduation from Leland-Stanford University in 1903, he became identified with the General Electric Company and subsequently with the Pacific Gas & Electric Company and then with the Lima Insulator Company. Later he joined the Akron High-Potential Porcelain Company, which was purchased by the Ohio Brass Company in 1910 and reorganized as the Ohio Insulator Company. Since that time he has been connected with the company. Mr. Austin is considered an authority on transmission line design and is the author of a number of scientific papers on this subject and on design and manufacture of insulators. He is a fellow of the American Institute of Electrical Engineers and a member of the American Society of Radio Engineers, American Society for Testing Materials and of other scientific organizations.

•

ALDERMAN B. J. SAMUELS of the London County Council has been elected unanimously chairman of the London Joint Electricity Authority to succeed W. F. Marchant, resigned. He has been a member of the Authority since its organization in 1925, vice-chairman since 1928 and chairman of the finance committee since 1927.

•

JOHN H. PORTER of St. Louis has resigned as a member of the Missouri Public Service Commission, effective August 1, after five years of service. Mr. Porter is planning to open a private engineering office in St. Louis after leaving the commission.

•

F. W. CRONE, who has engaged in publicity work for the public utilities in the Metropolitan district for some few years, has been placed in charge of editorial and publicity activities of the electric and gas companies affiliated with the Consolidated Gas Company of New York. Mr. Crone will be director of the editorial bureau of the companies. HENRY OBERMEYER, assistant to the vice-president, has been placed in charge of advertising for the group.

•

NORMAN W. STORER, consulting railway engineer for the Westinghouse Electric & Manufacturing Company, has been awarded the Lamme medal of Ohio State University, an honor bestowed on "a graduate of one of the technical departments for meritorious achievement in engineering of the technical arts." Mr. Storer was graduated in 1891 with the degree of mechanical engineer in electrical engineering. Since September of that year he has been continuously in the employ of the Westinghouse company. In charge of the railway department from 1904 to 1912, as general engineer assigned to special railway problems from 1912 to 1925 and as consulting railway engineer from 1925 to the present time, he has had a large part in the design of the company's transportation equipment. Mr. Storer is a fellow of the American Institute of Electrical Engineers and has served as chairman of several committees of that body. He is also a member of the A.S.M.E.

•

FRANK A. MERRICK, president of the Westinghouse Electric & Manufacturing Company, was made the recipient of the honorary degree of doctor of engineering by Lehigh University at the recent commencement exercises.

•

RICHARD T. LYMAN, sales representative of the United Electric Light Company, Springfield, Mass., has been appointed head of the service department of the Greenfield Electric Light & Power Company. Mr. Lyman has been identified with the Springfield properties since 1930.

▼

OBITUARY

WILLIAM A. GREEN, well known in Florida as an electrical engineer, and for many years superintendent of the old Consumers Electric Company of Tampa, died at his home in that city May 29 in his seventy-first year. Later he served as superintendent of the West Tampa Power & Water Company, subsequently becoming superintendent of the power plant in Fitzgerald, Ga., where he remained until his retirement in 1923.

•

JAMES A. SHEPARD, vice-president and consulting engineer of the Shepard Niles Crane & Hoist Corporation, Montour Falls, N. Y., died June 10 at his summer home, Kayutah Lake, N. Y., in his seventieth year. In partnership with his father and brother, Mr. Shepard established a foundry and machine shop in Montour Falls in 1880 for the manufacture of agricultural implements and for producing special castings, later under a new name engaging in the building of steel bridges and structural steel work. The bridge company was sold and Mr. Shepard founded the General Pneumatic Tool Company, later known as the Shepard Electric Crane & Hoist Company. Several years ago the Shepard company purchased the Sprague Electric Hoist Company and the Niles Crane Company and reorganized under the title Shepard Niles Crane & Hoist Corporation. Mr. Shepard was actively engaged with this company as vice-president and consulting engineer up to the time of his death. He was a member of the A.S.M.E.

COMPLETE LINE of RECTANGULAR SWITCHBOARD INSTRUMENTS

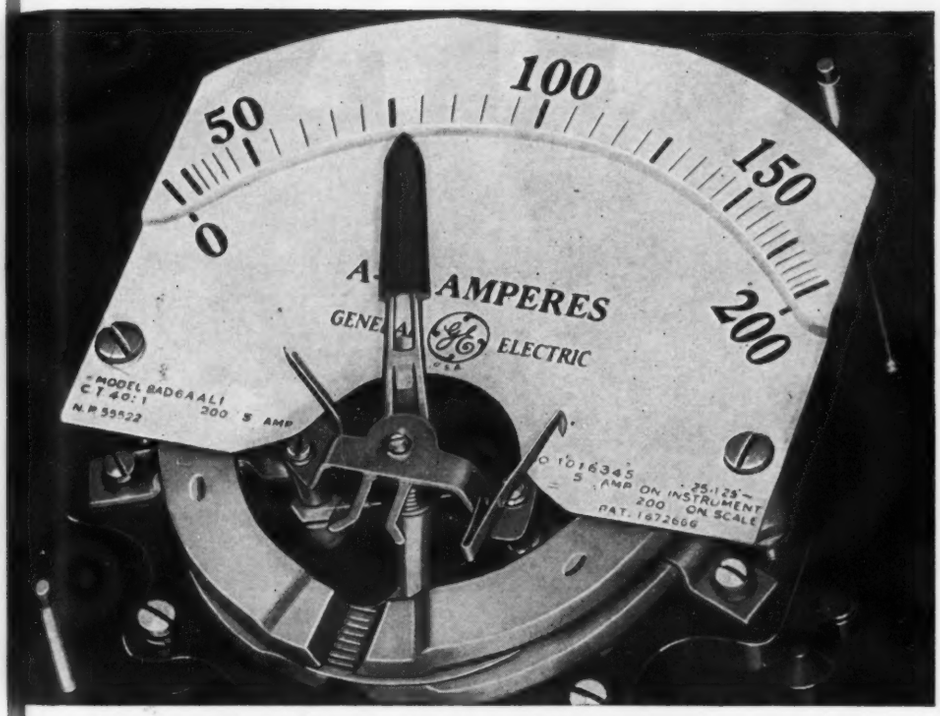
WITH

10

OUTSTANDING POINTS

OF ADVANTAGE

1. Antiparallax
2. Antiglare
3. Easy to Read
4. High Factor of Merit
5. Magnetic Damping
6. High Torque
7. Responsiveness
8. Permanently Constant
9. Three Styles of Cases
10. Attractive Appearance



This photograph was taken to show the antiparallax features. Note the size and shape of the pointer, and that it is in the same plane as the scale markings. Note, too, the size of the division lines and the omission of the usual enclosing line, to give added clearness. This view also shows the simple and sturdy construction

MAIL COUPON for Complete Information

10. Attractive Appearance

Attractive in themselves, these instruments, when mounted row upon row, create a harmony and symmetry which are in keeping with the trend of improved appearance in modern stations.

Moreover, four vertical rows with 6-inch center lines can be mounted on a 24-inch panel—thus making the most efficient use of every inch of space.

COMPLETE LINE

For *alternating current*: voltmeters, ammeters, wattmeters, power-factor meters, and frequency meters. For *direct current*: voltmeters and ammeters. *Special instruments* are also available, such as temperature meters, and radio-frequency and rectifier-type instruments.

To obtain more information about these new instruments, use the coupon at the right. Address the nearest G-E office, or General Electric Company, Dept. 6-201, Schenectady, N. Y.

General Electric Co.,
Dept. 6-201,
Schenectady, N. Y.
Gentlemen:

Please send me your bulletin GEA-1758, which contains descriptions and prices of your new rectangular switchboard instruments.

Name.....

Address.....

City.....

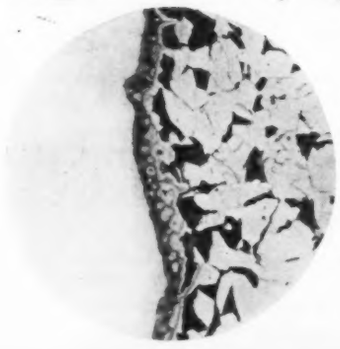
State.....

610-73

GENERAL ELECTRIC

CONTRO

Now you can b



Reproduction of 200 diameter micro-photograph of weld between copper and steel. Note interlocking crystalline structure of weld.

When you buy copper-covered steel wire for guy strand, overhead ground wire, messenger strand or telephone service—*you buy it for protection against corrosion.*

The CONTROLLED process by which CRUCIBLE COPPERBOND is made, provides three important improvements in *protection against corrosion.* ALL CRUCIBLE COPPERBOND production is by this process.

CRUCIBLE COPPERBOND is completely manufactured, sold and guaranteed by the Crucible Steel Company of America.

CRUCIBLE Copperbond

CRUCIBLE COPPERBOND DIVISION
405 Lexington Ave., New York City

LLED

buy [1] [2] [3]

CONTROLLED WELD

Temperature of copper and steel at instant of pouring must be closely controlled. Copper too hot results in contamination by excessive iron inclusions. Steel and copper too cool results in poor weld. Through CONTROL the iron content in copper on Crucible Copperbond is held below .2 of 1%.

CONTROLLED COPPER MELTING

Modern copper melting equipment pours copper directly from melting furnace to mold. Result of CONTROL is clean copper, free from gas, free from oxide segregations.

CONTROLLED COPPER DISTRIBUTION

More even copper distribution obtained by world's largest manufacturers of high-grade steels by CONTROLLED hot rolling, improved roll design, correct rolling temperatures, perfected hot-rolling practice. Minimum copper thickness held to 10% of radius of finished rod or wire. Thickness of copper in thousandths of an inch (rather than conductivity) is the proper standard of measure for rust-resisting wire.

CRUCIBLE COPPERBOND

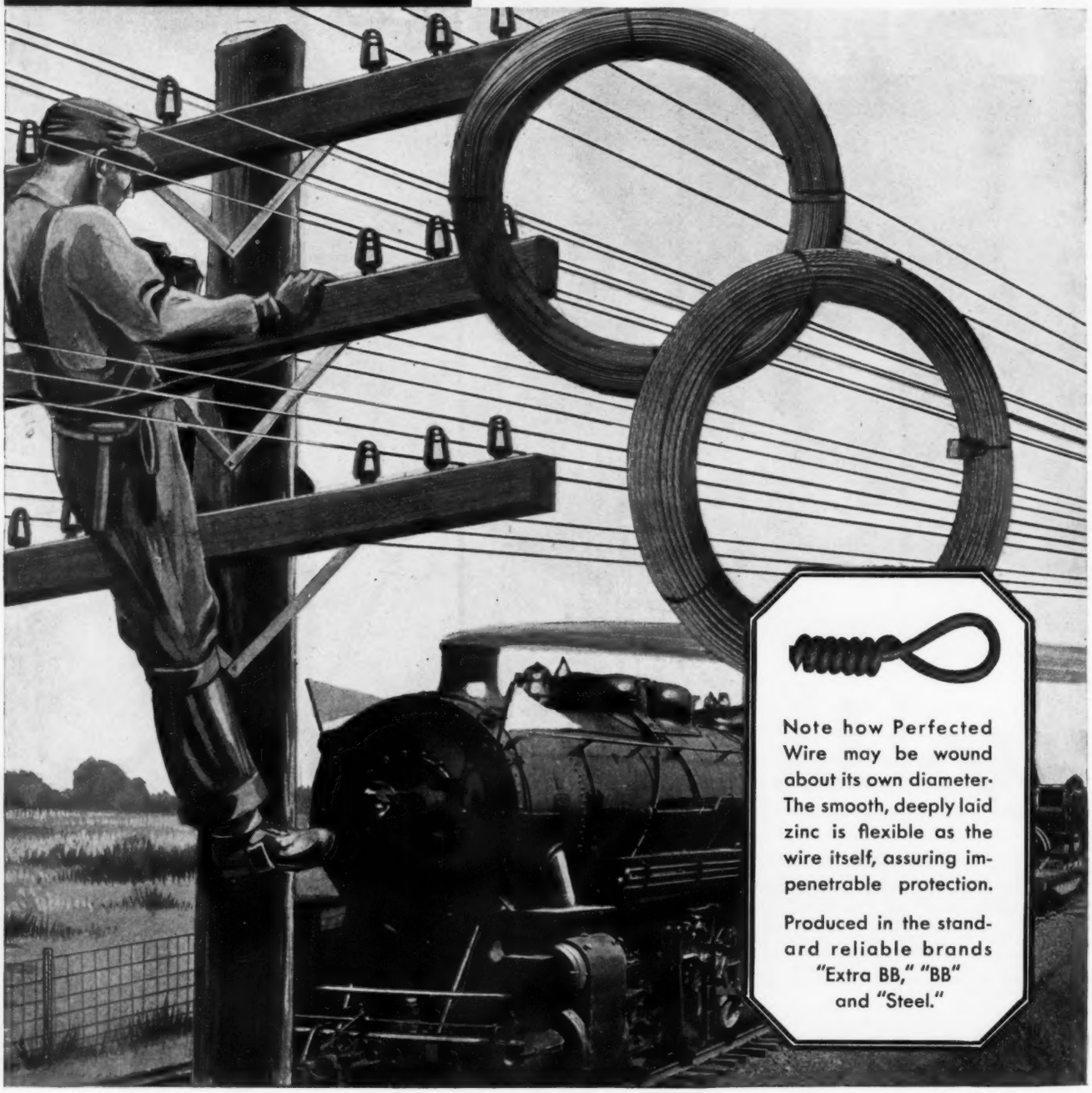
Write for revised specifications for copper-covered steel wires providing for a minimum copper thickness for all sizes of wires and suggested tests for minimum copper thickness.

CRUCIBLE STEEL COMPANY OF AMERICA

Branch Offices in all Principal Cities

PERFECTED
TELEPHONE, TELEGRAPH WIRE AND STRAND

LONG before the telephone and telegraph became important factors in the pulsing life of the nation—the American Steel & Wire Company was producing wire for many purposes. So—when communication systems demanded lines for the transmission of messages, it was only natural that they turned to this Company as the most dependable source of supply. Out of this demand has come Perfected Telephone, Telegraph Wire and Strand—products that are constantly uniform, heavily galvanized to resist corrosion—and that have a conductivity and tensile strength to meet the necessary requirements.



Note how Perfected Wire may be wound about its own diameter. The smooth, deeply laid zinc is flexible as the wire itself, assuring impenetrable protection.

Produced in the standard reliable brands "Extra BB," "BB" and "Steel."

1831 — MORE THAN 100 YEARS OF PROGRESS IN WIRE MAKING — 1933

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago
94 Grove Street, Worcester

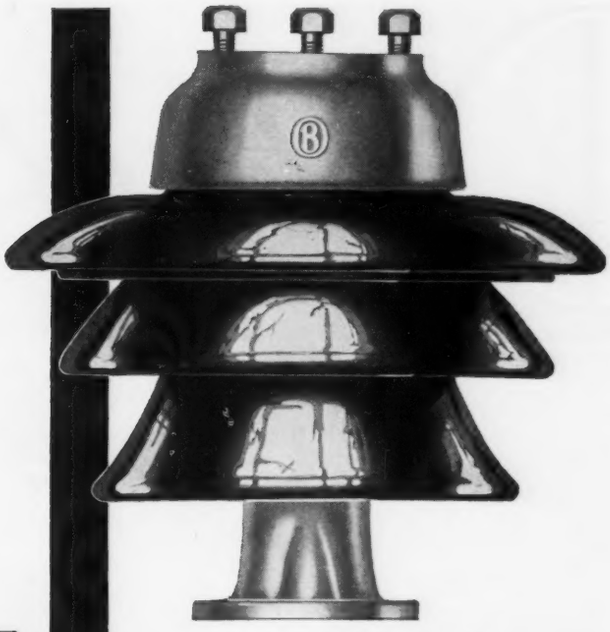
SUBSIDIARY OF UNITED STATES STEEL CORPORATION

Empire State Bldg., New York
First National Bank Bldg., Baltimore

AND ALL PRINCIPAL CITIES

Pacific Coast Distributors: Columbia Steel Company, Russ Building, San Francisco

Export Distributors: United States Steel Products Company, New York



A New O-B HEAVY DUTY UNIT *for Multiple Stacking*

THIS new unit, No. 31152, supersedes the popular O-B switch and bus insulator No. 26085. Strength, in the new member of the O-B family, has been increased considerably, giving greater rigidity to the assembled stack—a most desirable feature in switch operation. This has been accomplished through the use of larger and more rugged porcelain and metal parts. The height, bolt circle, and electrical characteristics remain the same, assuring interchangeability with 26085's. Like the unit it replaces, the full mechanical strength of the more rugged parts is utilized without a sacrifice to life. It has the same life characteristics long associated with O-B No. 26085; and in addition offers a standard heavy-duty insulator for multiple stacking at 220,000 volts.

INSULATOR NO. 31152
Mechanical and Physical Characteristics

UNITS	BENDING STRENGTH, LBS.	
	Upright (Base Mtd.)	Underhung (Cap Mtd.)
1	7500	4500
2	3000	2400
3	1700	1500
4	1200	1100
5	930	870
6	760	720
7	630	600

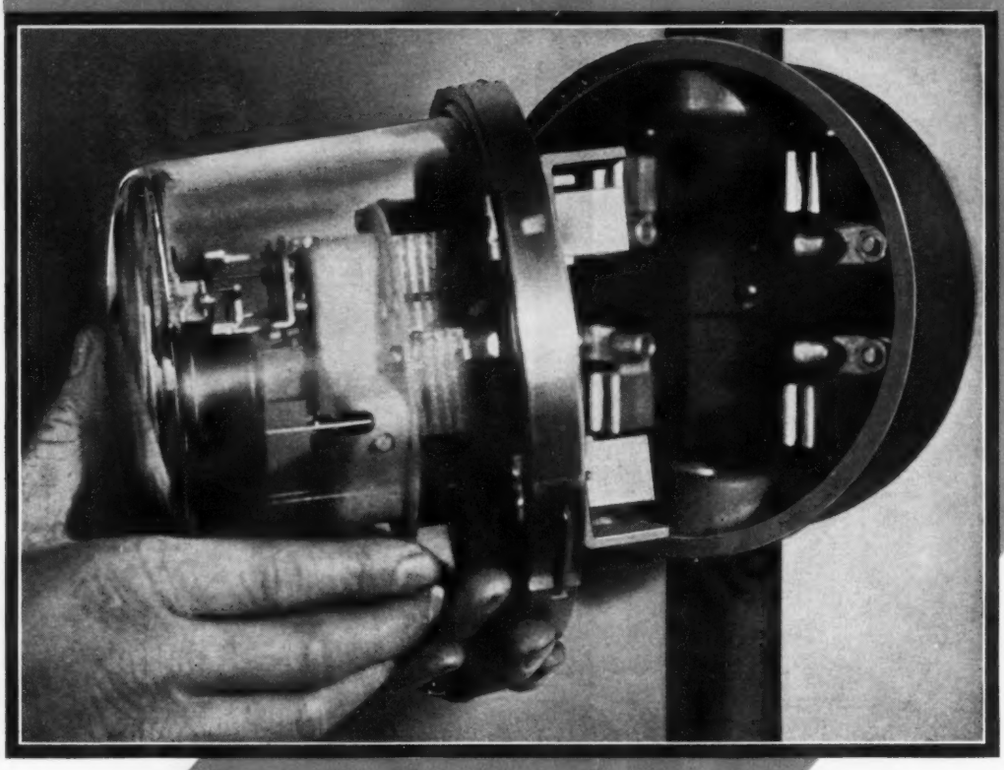
Tension Strength, 20,000 Pounds
Torsion Strength, 40,000 In. Pounds
Leakage Distance, 33 Inches
Net Weight, 80¼ Pounds

1617H

OHIO BRASS COMPANY
Mansfield, Ohio, U.S.A.
Canadian Ohio Brass Co. Limited, Niagara Falls, Ontario, Canada

New York · Philadelphia · Boston · Pittsburgh · Chicago · Cleveland · Atlanta · Dallas · Los Angeles · San Francisco · Seattle

Detachable



All old meters which have been armor-mounted with CS parts, and the new CS detachable meter are universally interchangeable in the type S meter-socket.

For the armor-mounting of old meters only four new parts are required. Left to right: Type S meter-socket, CS sealing ring, base plate (on which the element is mounted), and glass cover.

The new CS Detachable Meter, available in 5, 15, and 50-ampere capacities. Fully accurate up to 300 per cent of rating, it measures all loads up to 150 amperes.

Westinghouse

Quality workmanship guarantees every Westinghouse product

Metering...

FOR EFFECTIVE REVENUE PROTECTION *at Low Cost*

DETACHABLE metering provides effective protection for your revenue—and at very low cost.

With the meter armor-mounted, the wiring enclosed in metal conduit, and the installation outdoors in full view of the public, possibility of energy diversion is practically eliminated.

The low cost of the provision of such protection is made possible by the following advantages of detachable metering:

1. *Makes use of your present stock of meters.* All meters, accurate enough to warrant keeping in service, can easily and economically be made detachable with the CS armor-mounting parts—the type S universal meter socket, CS sealing ring, base plate and glass cover.

2. *Detachable meters are interchangeable.* Old meters which have been armor-mounted with CS parts are all interchangeable—with each other and with the new CS meter—in the type S socket. Even the armor-mounting parts themselves are interchangeable. Such standardization eliminates the necessity of maintaining stocks of equipment to fit different sizes and shapes of meters.

3. *Simple, inexpensive installation and removal.* A detachable meter plugs in and pulls out of the type S universal meter-socket like a radio tube. There are no connections to make or disturb. Service is discontinued by simply removing the meter and sealing the cover with a weatherproof plate. Meters need not be left in vacant buildings because of high cost of removal.

4. *Eliminates the need for permanently installed test facilities.* Testing can be done with a simple test jack which plugs on to the meter, and into the meter socket. Testing with the test jack provides greater safety for the meter tester, meter and transformer.

Your Westinghouse representative will be glad to help you estimate the savings that can be effected by adopting the new metering system, which includes the detachable meter, the Nofuze Load Center, and stroboscopic testing.

You are cordially invited to visit the Westinghouse Exhibit in the Electrical Building of the Chicago Century of Progress Exposition.

SEND FOR BOOKLET

Westinghouse Electric & Manufacturing Company
Room 2-N—East Pittsburgh, Pa.
Gentlemen: Please comply with the requests I have checked.

- ☐ Have an engineer call to discuss the savings possible from the use of the new Metering System.
- ☐ Quote prices on remounting old meters for detachable service.
- ☐ Send information on the new CS meter.
- ☐ Send information on the new metering system.

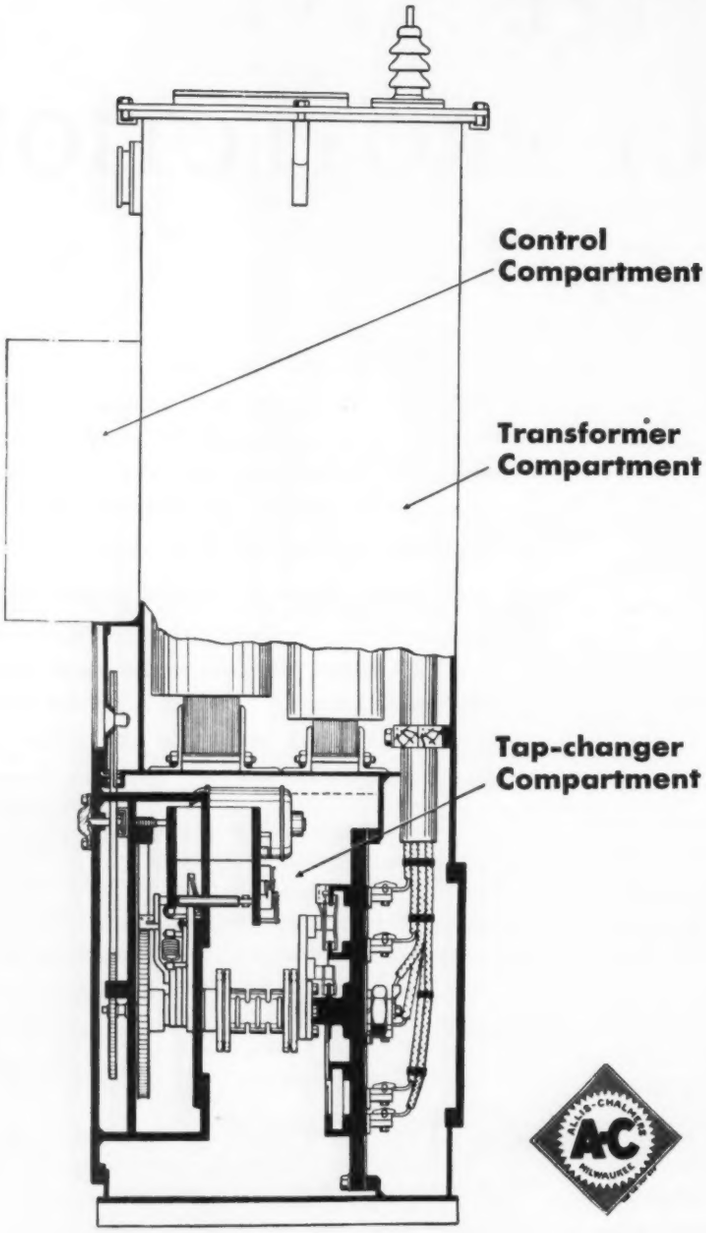
Name .....
Company .....
Position ..... T 79542
Address .....EW 6-24-33

The Answer!

to a long felt need . .

Economical Voltage Regulation

on feeders of any voltage



THE Allis-Chalmers Type AFR Automatic Feeder Regulator is new but it operates on an old principle.

It uses transformers and tap changing under load equipment to give new economies in voltage regulation.

With the 32 - 5/8 of 1% steps provided with but only eight physical taps in the winding a voltage curve as smooth as any other means of regulation is possible.

Since transformers are used, the high efficiency, low exciting current, high impulse strength, and strong mechanical construction, inherent with this form of apparatus is obtained.

The AFR Automatic Feeder Regulator can be furnished complete ready to install—with contact making voltmeter, line drop compensator, current and potential transformers built in, and a self-contained source of motor power.

Call the nearest Allis-Chalmers district office for additional information on this new feeder regulator. Consider filling needs for regulation never heretofore economically feasible.

ALLIS-CHALMERS

Allis-Chalmers Manufacturing Company, Milwaukee

OKONITE moves on with the WORLD

Exhibit of The Okonite Company, World's Fair, Chicago, 1893

Picture reprinted from "Electrical World" August 19, 1893

Founded in 1878, Okonite has continuously *specialized* in the manufacture of insulated wires and cables.

Progressive now, as it was during the last World's Fair in Chicago, The Okonite Company keeps moving to meet the new trends.

Now, as then, the name Okonite is a world-wide symbol for quality—an honest, absolute quality which assures long and satisfactory performance.

Its laboratories, factories and technical staff are up-to-the-minute, *specialized,* ready to furnish the best the art can produce.

THE OKONITE COMPANY

FOUNDED 1878

THE OKONITE-CALLENDER CABLE COMPANY, INC.

Factories: Passaic, N. J. Paterson, N. J.

SALES OFFICES:

NEW YORK CHICAGO PHILADELPHIA PITTSBURGH BOSTON ATLANTA
SAN FRANCISCO LOS ANGELES SEATTLE DALLAS

Novelty Electric Co., Philadelphia, Pa.

Canadian Representatives
The F. D. Lawrence Electric Co., Cincinnati, O. Engineering Materials, Limited, Montreal

Cuban Representatives
Victor G. Mendoza Co., Havana

OKONITE QUALITY CANNOT BE WRITTEN INTO A SPECIFICATION

YOU DON'T FIND THESE

THIS IS THE "RENTAL RANGE"

1 Waldorf is a big, expensive-looking range of the popular buffet type with full-size oven.

2 Quantity production in this one model permits a low price to utilities.

3 Waldorf was engineered for Rental purposes. It possesses every requirement necessary to keep it "sold": cooking speed, economy of operation, minimum service requirements, etc.

4 The public wants this range —as evidenced by immediate response wherever introduced. In seven localities, more Waldorfs were rented in one month than the previous year's total range sales!

WALDORF *manufactured by* ELECTROMASTER

WALDORFS *in warehouses*

ectromaster's Rental Plan puts them Right into the Kitchens

★

One Central Station Company has taken 1051 Waldorfs in the last 5 Months . . . and put them to Work Immediately Building Load!

Every Public Utility executive knows that the outstanding domestic load builder of today is the Electric Range. Reliable statistics show that on an average one home using an Electric Range consumes as much power as five customer homes without ranges!

But today there are two seemingly unsurmountable obstacles to building domestic load rapidly enough by the *sale* of Electric Ranges to meter-customers:

1. *The customer's extreme reluctance to committing herself to a major purchase, no matter how easy the terms.*
2. *The customer's traditional fear of the high cost of cooking with electricity.*

The Electromaster Rental or Optional Purchase Plan completely wipes out both of these obstacles. It puts a range into the kitchen without obligation further than a nominal month-to-month rental fee. The "sales resistance" is thereby limited to this fee—instead of being centered upon the ultimate purchase price. It eliminates obstacle Number 2 by permitting the housewife to *convince herself* that electric cooking with a modern, efficient range is *not* expensive.

Such a plan has been made possible and practical by the production of the Waldorf—the range designed in conjunction with Utility Engineers, and built specifically to fit the Rental Plan.

And this is important: The Electromaster Rental Plan recognizes the necessity for active dealer cooperation. It provides for more than simply a gesture of good will; it puts the dealer "into the range business" on a genuinely profitable basis!

If you want more domestic load with an absolute minimum of sales cost—here is your answer. The pioneering work is done. Electromaster has boiled down into three concise and interesting reports, the results of months of study, research work, and the practical application of the plan. We shall be glad to send them to any Public Utility Executive upon request.

★

Address:
ELECTROMASTER INC.
1803 E. Atwater St.
DETROIT, MICHIGAN

★

he Originators of the
TENTAL PLAN . . . . .

C O U P O N

Gentlemen: Please send me complete information regarding the Waldorf Range and the Electromaster Rental Plan.

Name _____

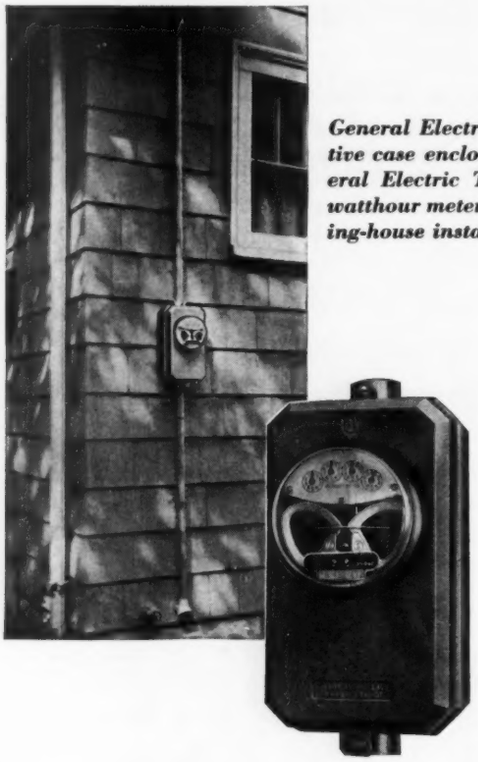
Position _____

Company _____

Address _____

Protection

for your revenues as well as your meters



General Electric protective case enclosing General Electric Type I-16 watthour meter in dwelling-house installation.

IN addition to providing years of protection for your watthour meters against the most adverse weather conditions, General Electric's new protective case makes access to the meter impossible without leaving positive evidence.

The case is die-cast of noncorrodible aluminum alloy, which excels in strength and durability. If desired, the case can be equipped with a special sealing screw, and with a glass seal which it is practically impossible to duplicate. The space between the meter cover and the box cover is tightly sealed against the entrance of moisture, by a thick rubber gasket which is under compression when the case is closed.

Ask for Bulletin GEA-1243B. General Electric Company, Schenectady, N. Y.

600-46

GENERAL ELECTRIC

Electric Bond and Share Company

Two Rector Street
New York

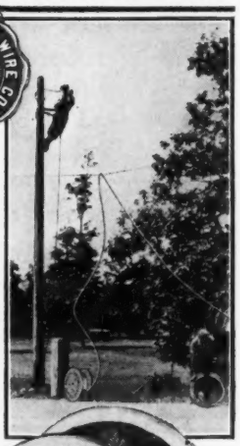
Crapo

GALVANIZED PRODUCTS

Seven Wire Steel Strand

• • • •

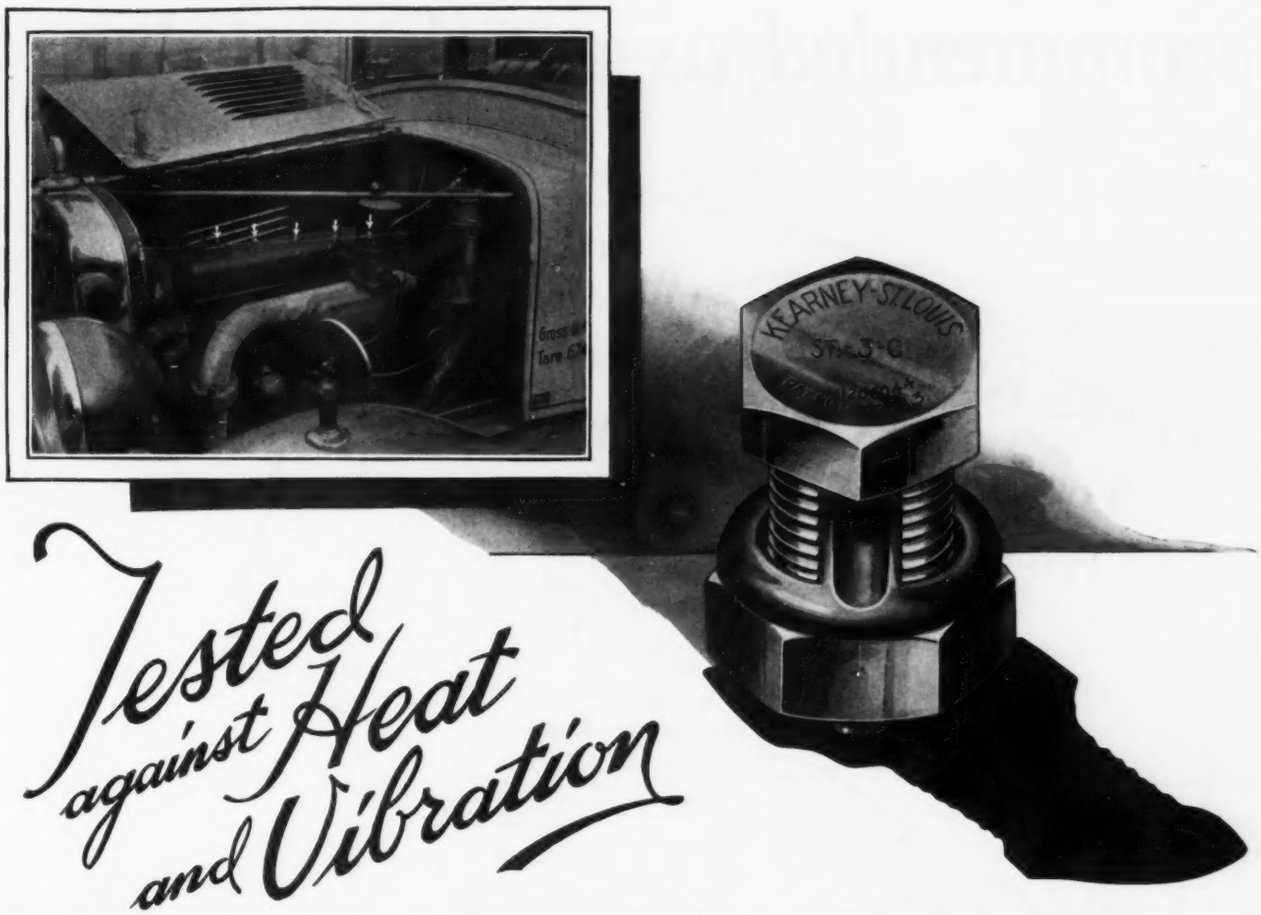
Telephone and Telegraph Wire



EXTEND the time of replacement... reduce maintenance costs ...by specifying *Crapo* Galvanized Products on all new and repair work! They combine every factor essential to long life and reduced expense: *pure* zinc coatings that neither crack nor peel, correct tensile values, proper ductility.

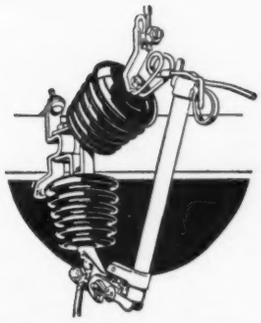
Insist upon genuine *Crapo* Galvanized Wire and Steel Strand! Representative Jobbers in all leading distributing centers can supply your needs immediately.

Indiana Steel & Wire Co.
Muncie, Indiana



Tested against Heat and Vibration

KEARNEY SOLDERLESS CONNECTOR



A fuse switch is no better than its link and holder. That's why Kearney Trip Out Switches are better.

KEARNEY PRODUCTS

Screw Anchors; Expansion Anchors; Solderless Connectors; Double Duty Cutouts; One and Two Insulator Fuse and Disconnect Switches; Trip Out Switches; Tripomatic Porcelain Housed Cutout; Porcelain Housed Disconnect Switch; Fuse Link Boxes; Fuses; Fuse Pullers; Pole Top and Quick-Break Gang Operated Disconnect Switches; Guy Wire Clips and Strand Bands; Lox-Round Guy Guards; Sleeve Twisters; Live Line Tap-Off Clamps; Economy Cable Clamps; Grounding Sets; Live Line Tools and Accessories; Underground Boxes; Hitemeters; Cable Ring Saddles; Dead-End Service Clamps; Conduit Straps.

THESE CONNECTORS, suspended as shown, were carried 45,000 miles from one end of the country to the other under conditions of changing temperatures and expansion and contraction from the heat of the engine without the slightest tendency toward loosening. No more severe test could be devised to show the ability of KEARNEY CONNECTORS to withstand even the most adverse conditions of installation. Ask to see these CONNECTORS when the Kearney display truck visits you.

A good connection is easily made with KEARNEY CONNECTORS because the only requirements are that the wires be well cleaned and the nut tightened down. They form a high pressure, permanent connection which cannot loose and the economies which their use makes possible points the way to greater savings in making electrical connections.

JAMES R. KEARNEY CORPORATION

4224-42 CLAYTON AVENUE • ST. LOUIS, MISSOURI

FACTORIES, St. Louis, Mo. • • Toronto, Ontario, Canada

Recommended as a prize study:

BUYERS REMEMBER THE "BUGS"

Long After Engineers Have Fixed and Forgotten Them

A Study of the Length of Time Required for the Public to Get Wise to a Defect and How Long It Is Before It Ceases to Be an Element of Sales Resistance

...variety ...table is an at... and to summar... as possible these ...and their ultimate ef... ...the public's ideas con... ...ing car defects.

Analysis of the periods of time required for the recognition and correction of car imperfections would indicate that *it requires from two to three times as long for the factory to make corrections* of a permanent and satisfactory character (if it does) as it does for the public to become generally aware of a defect in a new model, but what is far more important, *it requires at least twice to three times again as long for the public to be "resold" on that model*, and to feel certain that recurrence of the particular trouble will not take place.

For instance, if car owners discover the existence of some fault of design or manufacture with... about one month of delivery ... in turn knowledge of the ... comes general in... sales resista... ciently ... the...

Try it out on the PUBLIC

... they find it out eventually and react accordingly. The trouble is they don't come back if the reaction is unfavorable ... and how they do tell their friends!

Submit it to E. T. L. for test

... the findings of their mechanical, electrical or photometric laboratories being confidential the seller learns the facts before the buyer tells him ... and governs himself accordingly.

Passed by ELECTRICAL TESTING LABORATORIES

Summary of Survey Showing How "Bugs" Affect Sales

Make or Model	Approximate Time Req'd For Fault to Appear in Car	Time Req'd for Public to Recognize Fault as a Prevalent or Inherent Weakness in Car	Time Req'd for Factory to Recognize Change and Take Corrections Measures	Time Req'd to Fully Overcome Sales Resistance	Notes and Remarks*
A	7 to 8 months	7 to 8 months	Not corrected in that model	Car still thought be a "Lemon"	Unfavorable comment on this model reflected on acceptance of entire line. Service men could "predict almost to a day" when car would be back in shop with dissatisfied owner
B	10 to 30 days	6 months	18 months	3 years	Although trouble corrected in succeeding model and adjustments made on all cars in ...

An Article by Edmund B. Neil in the May 27th issue of Automotive Industries.

Excerpt from an E.T.L. advertisement Feb. 28th 1932 in Electrical World

Know by test

ETL

For a third of a century -the Industry's Laboratory

Electrical Testing Laboratories
80th Street and East End Ave.
New York N.Y.

ELECTRICAL WORLD

JUNE 24, 1933

25 cents per copy
McGraw-Hill Publishing Co., Inc.

The Power and the Glory

THE ROOSEVELT PROGRAM for domestic reconstruction has been made the law of the land. Promises must give way to performance and results will determine the success or failure of the administration's astounding experiments. Moreover, leaders in business, labor and agriculture must co-operate and administer details, for the government can only guide and lead the way.

THE SIGNIFICANT STATUTES AFFECTING THE ELECTRICAL INDUSTRY ARE

1. **The industrial recovery act . . .** This offers a possibility for a stabilization in manufacturing, wholesaling and retailing.
2. **The laws governing banking and security issues . . .** These offer no handicap to legitimate enterprises but will deter financial exploitations that injure the good name of the industry.
3. **The $3,300,000,000 construction program . . .** This will bring employment and increased purchases in which the electrical industry will share. It will also bring increased taxes.
4. **Discriminating and punitive taxation of utilities . . .** This makes aggressive selling a necessity.
5. **The Tennessee Valley development . . .** This project, together with that of Boulder Dam, will bring business to the electrical industry even though unjustified from an economic point of view.
6. **Inflation and the subsidizing of agriculture . . .** may have serious or negligible effects upon wages and capital in the electrical industry, depending upon how far permissive powers are carried into actual execution.

THUS there are both good and bad features in the administration's program. It will take time to carry out the program and to measure tangible results. The immediate program of the electrical industry should be to co-operate with the administration and yet intensify its efforts to grasp the opportunities available in the present upturn in national business. Now, as in the future, the industry must earn its prosperity.

A True Perspective on Utility Rates

THE R & S method of analyzing public utility billings puts the 12-month record of each customer on a single punched card. A graduated tabulation of these cards is then made, covering a whole year's cycle of consumption.

This gives the utility executive, on a single sheet of paper, an accurate picture of where his volume lies, where it begins to fall off, where it might be promoted either through the sale of appliances or through rate revisions. In addition, this method of tabulation provides an analysis showing total annual consumption by customers. Thus the entire picture of customer usage is brought into true perspective.

The 14 Advantages of R & S Utility Rate Service

1. ***Experience***—22 years of statistical fact-finding.
2. ***Specialization***—nothing to sell but service.
3. ***Equipment***—every modern mechanical tabulating aid, under expert supervision.
4. ***Accuracy***—mechanical accuracy subject to constant cross-check.
5. ***Speed***—enhanced by extra reserves of equipment and personnel.
6. ***Possibilities***—R & S reports permit simultaneous calculations of several alternatives of rate application, plus any desired supplementary data.
7. ***Economy***—demonstrably from 1/3 to ½ lower cost than any other method.
8. ***Thoroughness***—speed and economy permit the analysis of 100% of consumption data. No "sample" analysis compares in accuracy.
9. ***Simplicity***—analysis is made directly from meter books or ledgers without affecting clerical routine.
10. ***Verification***—all reports are capable of quick verification from original sources.
11. ***Certification***—the R & S reports as evidence before utility commissions carry weight as being expert, disinterested and authoritative.
12. ***Controlled Cost***—a predetermined contract price makes it easier to secure a fair amortization allowance.
13. ***Confidence***—service is completely confidential, and upon completion all records remain in hands of client.
14. ***Countrywide Service***—Complete R & S organizations in seven key cities operate everywhere in the United States and Canada.

It might pay you, in dollars and cents, to investigate the R & S special service for utilities and its economy in comparison with any other method of rate analysis.

RECORDING & STATISTICAL CORPORATION

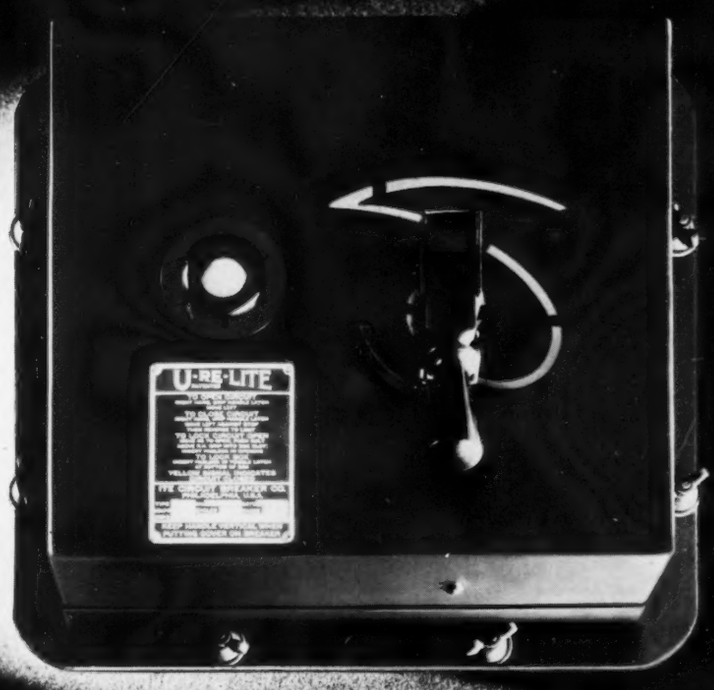
102 MAIDEN LANE, NEW YORK

The World's Largest Statistical Service Organization

Boston • Philadelphia • Chicago • Detroit • Montreal • Toronto

MANY CONTROL PROBLEMS CAN BE SOLVED WITH AIR CIRCUIT BREAKERS

I-T-E



DUST AND
MOISTURE PROOF
I-T-E U-RE-LITE FOR
STEEL MILL SERVICE

I-T-E CIRCUIT BREAKER COMPANY
SPECIALISTS IN CIRCUIT CONTROL PROBLEMS
PHILADELPHIA, PA.

UNIVERSITY OF MICHIGAN
GENERAL LIBRARY
ANN ARBOR MICH 2c

THE DESIGNS
ARE MORE
PRACTICAL

FROM COAST TO COAST UTILITIES ARE BUYING THESE *STRONGER INSULATORS*

Hemingray tougher glass insulator advantages are helping utilities to reduce distribution insulator costs. These insulators do not age or deteriorate in service. All internal as well as external surfaces are impervious to moisture.

The new Hemingray glass is a practical insulator material—it is thicker, tougher, stronger, resists both heat and mechanical shock, and can be depended on for long, trouble-free service life.

The new Hemingray insulator designs were developed through the cooperative effort of many utility engineers assuring the industry practical types for modern service.

Hemingray Insulators have proper shape and thickness of body and petticoats — no sharp edges. They are correctly annealed and are heat-shock tested. Available in either brown or light green color. Ratings up to 10,000 volts.

SEND FOR SAMPLES AND BULLETIN

HEMINGRAY PIN TYPE GLASS INSULATORS

HEMINGRAY GLASS COMPANY, MUNCIE, INDIANA